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AN EXPERIMENTAL STUDY OF CHARACTER TRAITS

By RAYMOND O. FILTER, University of Minnesota

I

STUDY OF SELF-ASSURANCE

Analysis of the Trait

The looseness of meanings attached to names of character traits demands first consideration. A trait must be defined in order to be studied intelligently. Because definition cannot be made with any degree of accuracy is no good reason for neglect of it. A little attempt to see as a whole and in its various aspects the trait which one studies is sure to be more effective than the procedure of devising tests and naming them as measures of anything at all.

Let the following table I illustrate an attempt at definition. It is a list of typical situations which commonly evoke the reactions that are given this trait-name, together with the reactions comprising the trait. That is, reactions which would represent a high degree of the trait are listed (in the second column) and negative responses, representing a low degree of the trait, are also shown (in the third column). The underlined qualification which appears prominently in the table, OTHER FACTORS BEING EQUAL, demands constant emphasis. Not only self-assurance but a host of other traits and conditions might be responsible for the reactions listed. These other factors must clearly be discounted or equalized before the reactions may be viewed as symptoms or measures of self-assurance. In experiment they must be recognized and evaluated or controlled.

In spite of its incompleteness and its errors (one error will be pointed out later on the basis of experimental findings), the table at once shows its usefulness. One devises tests

TABLE I

SHOWING TYPICAL SITUATIONS AND REACTIONS INVOLVING SELF-ASSURANCE

Situations	Reactions Other Factors Being Equal	Negative Responses
1. A new situation demanding response.	Undertaking with readiness, carried out beyond demands.	Excessive inquiry—and waiting for directions.
2. A new situation inviting response.	Ready acceptance.	Declined; or needing stronger invitation.
3. Many tasks inviting response.	Acceptance of many.	Carrying a light load.
4. A task demanding preparation.	Tendency to undertake without thoro preparation.	Careful preparation.
5. A task recognized as imposing, difficult.	No hesitation, total engagement, not half-hearted attempts.	Hesitation—partial performance.
6. Responsibility offered.	Accepted.	Avoided
7. Responsibility not offered.	Sought—opportunity made.	Not desired—probably not thought of.
8. Opinion asked.	Readily given.	Modestly withheld or qualified.
9. Estimate of one's own qualities called for.	Given with little delay.	Long pondering.
10. Selection, preferences called for.	Speed of decision.	Slow, wavering decisions.
11. Estimate of one's own capacity to perform certain tasks called for.	Selection of material near limit of capacity, or over-estimation.	Under-estimation.
12. Contradicted when asserting one's own memory of an event, act, etc.	Denial of error.	Acceding.
13. Contradicted in personal convictions by authority and by associates.	Maintenance of conviction (not necessarily public expression).	Suggestible (Re matters of opinion.)

which shall approximate some one or a few of these type situations, and then the table does its further service of preventing generalizations. Successful measurement of some one aspect or element of the trait must clearly be regarded as no measure of the trait. Until its relation to the trait in all of its aspects is determined, no single measure can be safely labelled as a test of self-assurance and be used as such.

Experimental Procedure

In addition to the recognition of the complexity of a character trait there is necessary some insight into its nature as an attribute of individuals. Is it a relatively constant or a variable attribute?

Let us restrict the inquiry at first to just one aspect of the trait, namely to item No. 11 in table I, to expressions of tendencies towards over-estimation. The problem is, to what extent do persons who over-estimate (or under-estimate) their capacities in one situation—on one kind of material—tend to do so in other situations—on other materials?

The different tests which were devised, and applied, vary in value as controlled measures of over-estimation. Only two of them are worthy of complete description. These two tests, however, do seem to possess advantages which should be noted. In the first place, they serve the present purpose very well, of presenting two situations for comparison, which are identical in every respect excepting in the matter of material on which the estimate is based. Test No. 1 calls for estimates of one's capacity to manipulate; test No. 2 calls for estimates of one's capacity to reorganize and reproduce visual impressions; both activities are equally unfamiliar or equally unpracticed (at least in the case of all the subjects to these experiments); and manner of presentation of the material, and all other conditions are identical. In the second place, both tests are objectively scorable.

Test No. 1. STRING FIGURES. (Photographs from Caroline Furness Jayne's book, "String Figures," C. Scribner's Sons, 1906.)

Preliminary: Task was to reproduce with loop of string on fingers patterns shown clear and traceable on pictures. Three patterns, a very simple one and two of representative complexity, were tried, and Subject informed regarding the amount of time he needed for each.

Test Question: Showing S ten more, one at a time, ask: "Which ones of these do you feel sure you would be able to do if allowed 4 minutes for each?"

Criterion of Self-assurance: Number chosen plus number over-estimated (as shown by actual performance tested later).

Measure of Speed of Decision also obtained: Total time from moment No. 1 is handed to S until No. 10 has been chosen or discarded. S not aware of the fact that time is being taken.

Test No. 2. DECOUPAGE. (Binet's test extended.)

Preliminary: Task was to "Draw what the folded and torn paper looks like opened up." Three different patterns tried, the original Binet and two other simple ones. Subject allowed to compare his drawings with the actual pattern.

Test Question: Ten more are folded and torn, and S asked after each one—"Could you do this one correctly, if you were to see it folded once more later, just before drawing it?"

Criterion: Number chosen plus number over-estimated. Speed of Decision measured:—total time of choice—the folding procedure being practically constant for each S.

Dr. June Downey's Will Profile (U. of Wyoming Bulletin No. 3, 1919) contains a test of Assurance, which was utilized in this study. Two sealed envelopes, one stamped M and the other N, are held before the subject for selection. They are then put aside for a while, and when later brought under reconsideration, E makes a point of contradicting the assertions of S relative to which of the two envelopes he had previously chosen. Degree of resistance to contradiction is scored by comparison with standard sample responses. The scoring of this test is not strictly objective as in tests No. 1 and No. 2.

Two tests of Speed of Decision were also given. According to the definition of the trait, table I, items 8, 9 and 10, speed of decision was presumed to be to some extent indicative of self-assurance. Therefore measures of speed of decision were secured in connection with tests No. 1 and No. 2, and two more tests of speed of decision were borrowed. Again Dr. Downey's Will Profile provided a measure, in the Character Checking Test. A list of character traits in pairs is presented and S instructed to check the one trait in each pair which he thinks he possesses. Amount of time employed determines the score.

A modification of Münsterberg's Decision test, the form devised by Sybil Marsh Gibson (A Decision Study of 150 Young Men and Women. *J. of Applied Psych.*, Dec. 1920), constituted the other test of speed of decision. Cards bearing the letters E, I, Y and K, in scattered arrangement, are given S to be examined. S is to decide, without counting, which one of the four letters appears most often on the different cards.

Time and accuracy can be scored, but only time was scored for the purposes of this study.

These tests were given to a group of 26 University students, members of several classes in psychology, and yielded the following results. Disregarding for the present the bearings of speed of decision, and confining attention to the three tests of assurance, the correlations by Rank Difference Method were:

Between Test No. 1 String Figures and Test No. 2 Decoupage } r = .09

Between Test No. 1 String Figures and Test No. 3 Assurance (Downey) } r = —.10

Between Test No. 2 Decoupage and Test No. 3 Assurance (Downey) } r = —.10

Here is a fair demonstration of variability. If it were established on the basis of a greater number of cases we should conclude that possibly our trait of Self-assurance is purely a function of external factors—of the particular situation—and no constant attribute of individuals at all. What is unequivocally demonstrated is the fact that no one of these tests can be rightfully used alone as a measure of assurance.

Tests No. 1 and No. 2 are of a nature which permits of repetition on the same individuals, after an interval of several months probably, and their reliability may be determined. This has not yet been done.

An attempt has been made to determine the validity of the tests as measures of self-assurance through correlation with estimates. A rating scale was prepared which described six types of individuals, varying in degree of self-confidence, with a grade assigned to each; and then groups of subjects were found who were well acquainted and who provided estimates of each other. The rating scale was successful in serving as a real aid to the judges and in securing very close agreement (M. V. slightly more than a half step) in the different estimates of the same person. But no test results were found to correlate very high with the estimates.

TABLE II

Correlations with estimates. Two different groups:
6 boys, members of one fraternity.
14 girls, members of one sorority.

Measures of Over-estimation	6 cases	14 cases
Test No. 1 String Figures r =	.70	.32
Test No. 2 Decoupage	.70	.28
Measures of Speed of Decision		
Time in Test No. 1	.07	—.14
Time in Test No. 2	.19	—.42
M. Decision Test	—.10	.54
Character Checking	.17	

It became apparent that a mistake was made in attempting to correlate specific test results with estimates on self-assurance considered generally. In order that estimates may serve as a criterion of a test they should be based upon knowledge of activities related to those involved in the test, and upon such activities alone. The scale should be replaced by a number of scales, each descriptive of some different specific kind of self-assurance. In the same manner as the subjects were graded by friends for self-assurance in general (on the scale used), they might be graded for self-assurance in limited spheres of definitely specified types of situations—in matters of athletics alone, or matters of scholarship alone, or in handiwork, or brain work, or in home circles, or in public view, etc., etc.

The following table III summarizes all of the correlations between measures of speed of decision. The correlations are based on as many cases as could be compared, regardless of groups.

TABLE III

No. of cases		
20	Time in String Figures and Decoupage..... r	.38
20	Time in String Figures and M. Decision....	.29
20	Time in Decoupage and M. Decision.....	.28
	(Subject No. 42 was first in speed in all three of these tests.)	
22	Time in String Figures and Char. Checking.	.30
33	Time in Char. Checking and M. Decision...	.15
45	Time in M. Decision and Accuracy in same.	—.50
14	Average rank in Speed of Decision and Estimates	—.02

Conclusions

Evidence showing that the two original tests, No. 1 and No. 2, actually serve as measures of Self-assurance is not at hand. That they possess certain advantages, however, was noticeable to all who studied the tests and observed the reactions to them. The most promising features may be enumerated as follows:

1. Scorable on a strictly objective, quantitative basis.

2. Reactions represent actual attitude of S, not a mere guess without insight.

The trials given are directly comparable with the material estimated.

3. Other factors fairly well controlled.

The objectivity of the material precludes likelihood of much change in reaction under varying subjective conditions.

Test activity uninfluenced by experimenter.

Recognition of purpose of the test makes little difference. Desire to show much confidence in estimating is counterbalanced by desire to show ability to perform the patterns chosen.

Note the correlation of —.02 between average rank in speed of decision and estimates on self-assurance. Though the criterion is faulty, as already indicated, it nevertheless serves for comparison and probably has some value for showing general relationship. Whereas the measures of over-estimation showed low but positive correlations (table II) with the estimates, none of the measures of speed of decision show consistent agreement; and their combined effect (table III) is seen to be entirely unrelated.

A distinction which was not made in Table I, where the trait was defined, is brought to mind by this observation, namely a distinction between decisiveness, or strength of decision, and confidence in one's own powers, or self-assurance in its true meaning. It is a distinction between the manner in which the decision is given, and the kind of decision given. Speed of decision, as a mode of decision, is probably an expression of decisiveness rather than of self-assurance. At least, it does not appear to be the latter. Items 9 and 10 in the table I, defining self-assurance, should evidently be discarded. Whether other measures of decisiveness (such as can be secured by answers to the question, how sure are you? by double checking answers, etc.), whether these show a close relationship to measures of speed of decision, has not been determined. Their relation to measures of self-assurance should also be ascertained.

Quite clearly, too, Speed of Decision seems not to be measured adequately by the Downey Character Checking test, nor by any other single test. Surely when we speak of speed of decision we are as likely to be understood to mean that an individual will decide quickly how much or how difficult labor he can undertake (the consideration under tests No. 1 and No. 2) as to mean that he will quickly decide which trait he possesses (the consideration in the Character checking test). And the results show (table III) that to measure speed in one gives little or no indication of speed in the other type of decision. Such facts should be kept in mind when speed of decision is the subject of conversation.

Possibly if a larger group of persons is brought under examination in a greater number of tests a degree of constancy or generality of the trait may be discovered, but we have no evidence of that possibility beyond the one presented here

in the case of our subject No. 42, who led in speed of decision in three tests, choosing more rapidly than all her comrades in String Figures, Decoupage, and M. Decision test. It is exceedingly regrettable that the Character Checking test had to be eliminated from her group because of mere lack of time. (S No. 42 was ranked 8th, with grade C, for Self-assurance by her friends.)

Speed and Accuracy in the M. Decision test show a distinct negative correlation (r —.50).

The extension of these tests to a greater number of subjects, and also comparison with a greater number of similar tests composed of varied kinds of material, is essential to the definite determination of whether the tendency towards over-estimation is or is not a highly variable and unpredictable trait, and whether or not any one test may be expected ever to serve as a measure.

With reference to the general program of learning something about Self-assurance, it is demonstrated emphatically that we have succeeded no farther than to outline the problem and discover the difficulties that beset its solution. The way for progress is indicated to some extent in our recognition of the need, just expressed above, of completing first the observations relative to the one assumed element of the trait, Over-estimation. We need to know whether or not the tendency to over-estimation can be measured before measures of the total trait can be looked forward to.

The road by which we must climb to insight into character should not be regarded as a highway to be covered with a bound. Quick, quantitative results may establish useful enough measuring devises, but may leave us at the end totally ignorant of what we measured.

Summary

1. Over-estimation, based upon good insight, is a promising criterion of Self-assurance.

2. Tests No. 1 and No. 2 possess advantages for the observation of tendencies to over-estimate. (But the tests are lengthy taking about 20 to 30 minutes each, with the necessary three trials, selection, and then performance.)

3. Tests No. 1 and No. 2 serve excellently for measure of Speed of Decision, on a significant type of decision—"How much can you do?" (Performance not necessary in this case, hence tests can be given in about 10 minutes each.)

4. Speed of Decision is probably not indicative of Self-assurance.

5. Little constancy in speed of decision on different materials is manifested.

6. There is a marked negative relation between Speed and Accuracy in the Münsterberg Decision test.

7. The classification of specific self-assurances and development of separate criteria (rating scales, et al) for each, is a suggested future program which may make possible the determination of validity of tests.

II

Study of Speed of Decision

An early study by J. W. Bridges (An Experimental Study of Decision Types and their Mental Correlates, Psych. Mon. XVII, No. 1, 1914), concludes with the following assertions regarding speed of decision:

1. Some subjects are very quick and constant in simple situations but are relatively slower and more inconstant when decisions are more difficult.

2. Those quick in subjective decisions are not always quick in objective decisions. (Objective are decisions on matters quite apparent to sense, like judging which card had more holes in it—they would be easily and certainly scored; subjective are decisions on matters of taste and opinion—difficult to score.)

3. In general, practice has no marked effect upon decision time.

In the face of this evidence the use of the two objective measuring devices of character which exist [1] definitely implies a faith in the constancy of character traits, and of speed of decision among them. For when using the scales one gives a grade on speed of decision though only one, or at the most, two kinds of decision have been measured.

Thus the common-sense notion of the trait seems to be carried into scientific usage, where it demands further searching inquiry. In the case of these scales, it may be that the choice of materials has been an exceedingly happy one, and that speed of decisions (in the plural) is fairly well represented in the results (as is evidently assumed); but this seems by no means to have been demonstrated.

Is speed of decision a trait—a general trait, of which we may speak in the singular? Is it a constant and predictable

[1] Reported at the Chicago Meeting of the American Psychological Association, 1920.
(1) A Group Will-temperament Scale, reported by Dr. June Downey.
(2) Test No. IX, Form 1800, of the Bureau of Personnel Research of the Carnegie Institute of Technology, reported by M. J. Ream.

characteristic of an individual's reactions, regardless of the nature of the decisions called for? Are there individuals who show themselves to be quick in decisions of all kinds? Or of many kinds? Or of customary kinds? Are there other individuals who excel in one or a few kinds of decision, while they prove ordinary or very slow in other kinds?

Such, and related, questions must be answered before the hope of securing any single representative measure of speed of decision can be entertained.

It was seen that Bridges has given a negative reply to the main questions suggested above. His answer, however, may be regarded as not decisive, inasmuch as it was arrived at by observation of only 19 subjects. It gives only a suggestion of the probable nature of the trait in the general population.

However, the investigation on Self-assurance just reported in the foregoing section, disclosed again a condition of lack of constancy in the speed of decision of a group of 20 persons, and more in some cases. None of the time correlations is high, .38 being the highest found between any two tests. But with this observation and its support of the view in favor of a general lack of constancy in speed of decision, the very noticeable fact appears that one subject in the group of twenty took first rank in speed in as many as three different tests. Such a fact discourages the hasty generalization regarding the inconstant and unpredictable nature of the trait. Possibly larger groups than those tested so far contain more of such individuals who distinguish themselves by the possession of general superiority, or inferiority, in speed of decision. The present investigation is now an attempt to determine the strength of this possibility by varying and extending the observations.

The aim is to measure the reactions of a large group of individuals to a variety of decision-problems, and to observe whether constancy or variation in speed is the rule; to observe also if possibly the general rule for the mass hides any significant groups of exceptions.

Description of the Tests

A brief statement of the instructions for each test, and where possible an illustration of the material, is given here. In practice the instructions were read aloud to the subjects, and the tests were bound together in the form of a pamphlet. No test was seen before signal to start was given. After one test was completed all subjects listened while instructions for the next one were read. So through all six.

Test I. Check the one trait in each pair which you possess:

Patient	Impatient
Cautious	Reckless
Dull	Clever
etc.	

Test II. Write in small square below each group the most frequent letter:

This test has been described in the foregoing section, as the Munsterberg Decision Test modified by Sybil Marsh Gibson.

Test III. Grade these actions as follows:

If VERY VERY GOOD.....VVG
If VERY GOOD.....VG
If GOOD.....G
If INDIFFERENT.....I
If BAD.....B
If VERY BAD.....VB
If VERY VERY BAD.....VVB

To be an active church member.....

To praise your own cooking.....

To tip your barber regularly.....
etc.

Test IV. Check the one item in each pair which in your opinion has the greater value *to the human race*:

tea kettle.....flatiron.....

science.....music.....

mirrors.....keys.....
etc.

Test V. Compare each of the figures below with the small square above the line. Write an S, L, or E inside of each figure—

S if smaller than the square in area
L if larger than the square in area
E if equal to the square in area

Test VI. Which is the greater evil, generally? Check one of each pair. Do not skip, but take one pair at a time in order:

To use cosmetics (paint).....	To chew gum noticeably in public.....
To frequent burlesque.....	To frequent bull fights.....
To hunt out of season.....	To be instrumental in reinstating capital punishment.....
	etc.

Test I is the Downey test for speed of decision, with a few additional traits added to the list. Test II is the M. Decision test, modified and transformed from a card sorting test to a paper test, but retaining its essential characteristics. Tests III, IV, V, and VI are original contributions, though clearly patterned after many of the questions and problems that have been devised to test moral disposition and appreciation. One feels a distinct freedom from the hazardous interpretations of the student of moral disposition in employing material of this kind in a manner which disregards the nature of the responses given. For here the concern is only speed, and no interest is attached to the values of the replies. Of course, the subjects taking the tests are instructed in a manner to produce careful consideration on their part. Even purely hypothetical norms of performance are referred to as actual in the instructions in an attempt to make the subjects feel the need of careful judgment, and to make accuracy of performance appear the significant consideration in the score.

The different tests call for a variety of decisions. They are planned to bring into play a number of different kinds of factors—to stimulate a variety of the typical considerations —that tend to make people hesitate when deciding. Test I is distinctive in its demand upon self-reference, and it invites all the difficulties of introspection and the hesitations due to modesty in assertion. Test II presents objective, easily verifiable material, but it deprives the subject of the method by which he would ordinarily determine his answer. (He is not permitted to count the letters.) The question differentiating persons in this test seems to be: "Can I trust the hasty impression?" Test V involves decisions of the same objective kind, and the same causes for hesitation.

Tests III, IV, and VI are of a kind in presenting subjective material for judgment—that is, the decisions are to be based on matters of opinion, on social and moral considerations of a high degree of complexity, on personal convictions. Test III differs from test VI only in its demand that grades be assigned as answers, in place of the mere check on a paired comparison. It calls for absolute judgments in contrast to the relative judgments of test VI. Test IV has an advantage among these tests of so-called subjective decisions in reducing the element of speed of reading which possibly affects the scores on these tests.

Results

A time limitation was set on the tests, and amount of work —number of decisions—scored.

The number of records obtained was 142. They represent the reactions of a very homogeneous group of university students, mostly under the Junior year in school, though including a few advanced students. The records of the latter, however, show no noticeable deviation from the rest.

The time limitations for the various tests were determined by preliminary trial upon a group of 25 students, and set below the fastest performances in that group, the aim being to have no persons finish the test. Unfortunately this trial group, an evening class in Applied Psychology, did not contain the most speedy performers, and as a result the tests were launched out upon the regular class groups with a time limitation too lenient. Quite a number of individuals finished some of the tests. This circumstance causes a distortion of the distributions of scores which must be referred to later when results are interpreted.

INTERCORRELATIONS OF TEST RESULTS. 142 CASES. PEARSON PRODUCT MOMENTS FORMULA

	Test I	Test II	Test III	Test IV	Test V	Test VI
Test I	...	.43	.47	.56	.31	.51
Test II	.43	...	.51	.50	.66	.32
Test III	.47	.51		.55	.45	.40
Test IV	.56	.50	.55		.57	.46
Test V	.31	.66	.45	.57		.37
Test VI	.51	.32	.40	.46	.37	

These coefficients of correlation are not as useful as are other summarizations of the results which follow. In the first place the distortion of distributions—the above-mentioned massing of scores at the top of each scale, due to the fact that the time allowed for the tests was too great—has an influence upon these correlations which is difficult to estimate. It must lower it somewhat, though probably not a great deal. In the second place, this influence is not equally strong upon each of the correlations in the table, and comparisons must be accordingly uncertain.

If the coefficients are accepted at their face value, or with some allowance for the attenuating circumstance, they would seem to indicate a degree of constancy in speed of decision. Those persons who are quick in decisions of one kind tend to be quick also in decisions of quite another kind. The correlations are not high enough, however, to warrant the con-

clusion that any one test would serve as a measure of speed of decision. This is the important conclusion which may be safely drawn from these figures. It seems almost absurdly simple as the objective of elaborate investigation, but after all, the demonstration serves a good purpose. It is essential to the success of character testing that pictures of this kind be presented, for without them exalted opinions regarding the worth of single tests are apt to prevail. Later figures will show how unfortunate would be a classification of persons according to score on one or two tests of this trait.

The two tests which show the highest correlation with one another are numbers II and V, the two which have been described as objective and as being in that respect similar to each other and quite different from the others. Evidently this feature is reflected to some extent in the higher correlation. It means that a number of the individuals at least show a relatively greater constancy in speed in decisions of an objective nature than in the other types of decision. However, another similarity of the two tests, besides their objectivity, should be noted, for it may account for the higher correlation. The two tests are, after all, visual perception tests, and it is likely that equality of visual endowment, or more likely still, equality of practice in gauging by visual impression, may to a large extent determine the correlation.

The table of intercorrelations shows a still further distinction between these two objective tests and the others. If the averages of the columns be taken, with the rows II and V omitted, the figures resulting are as follows:

Test I	Test II	Test III	Test IV	Test V	Test VI
.513	.440	.473	.523	.425	.456

These figures show the averages of the correlations of each test with all others excepting II and V, and it becomes clear that tests II and V have the lowest average correlation with the rest of the tests. On the whole there is less correlation between the speed in objective types of decision and the subjective types than there is between the different subjective types here tested. This corroborates one of the observations of Bridges, reported at the beginning of this section.

A further very simple statistical treatment was applied to the test results, which yielded returns of considerable value for insight. It supplied a means of classifying the individuals tested, it presented a more intimate picture of the actual meaning of the correlations (uninfluenced by the disturbing attenuat-

ing circumstance), and it allowed a further comparison of the tests. The procedure was as follows: On the basis of the various distributions the grades in the various tests which represented most closely the 20 percentile score and the 80 percentile score were determined. These served then to differentiate the upper and the lower 20% individuals from each other and from the middle (60%) group. The choice of the 20 percentile as the distinguishing level was made after a scrutiny of the various distributions of scores. It was found by trial that the 80 percentile fell upon an even score in most of the tests, that is, definite groups were more regularly divided at about this point than at other points (like the 25 percentile) which were tried. The lower group is really marked off by the 23 percentile score. Thus the individuals were classified as being either speedy, slow, or ordinary in each test. On the score sheet, then, it became a simple matter of drawing a circle in black ink about all scores above the 80 percentile score, and a circle in red ink about those below the 20 percentile score. A small section of the score sheet is reproduced here to illustrate the effect of this procedure.

SCORES

Subject	Test I	Test II	Test III	Test IV	Test V	Test VI
No. 125.....	(5)	(7)	22	(25)	20	12
No. 126.....	(9)	13	(13)	(29)	22	13
No. 127.....	(25)	(24)	(39)	(48)	(34)	(20)
No. 128.....	16	(5)	25	38	(33)	(10)
No. 129.....	10	(24)	(21)	37	23	(7)
No. 130.....	(7)	18	(34)	39	(10)	(18)
etc.						

Now to count the number of circles of different color which characterize the different individuals becomes an easy matter. The following table summarizes the counts. The first column shows the number of black circles, that is, the number of tests in which the individuals were among the upper 20% for speed; the second column shows the number of individuals who attained that status (who had that number of black circles to their credit). The third column and the fourth column, respectively show the same facts for the lower 20% (number of red circles) as columns one and two.

No. of tests	No. of persons high	No. of tests	No. of persons low
6	6	6	2
5	2	5	6
4	6	4	10
3	10	3	16
2	21	2	20
1	30	1	27
0	66	0	58

0 high and 0 low (middle grade in all tests) (with no circles of either kind).....12

This table indicates that 6 persons were in the upper 20% of the group of 142 in all 6 tests (like No. 127 in the section of the score sheet on the preceding page), 2 persons were in that group in 5 of the tests, 6 in 4 tests, 10 in 3 tests, etc.; and among the slow individuals, 2 were exceedingly slow in all 6 tests, 6 in 5 tests, 10 in 4 tests, etc. There were 12 individuals who failed to reach either the fast or slow status in a single one of the tests.

Clearly, there are here discovered two groups of individuals, and probably really three, to whom the general attribute of speed of decision, in some one of its forms as quick, slow, or mediocre, may be referred without much danger of inaccuracy. The one group of 6 individuals definitely possesses the quality of quickness in decision, as far as this number of tests gives evidence of it. Another group of 2 individuals may be labelled slow; and a third group of 12 individuals are characterized by constant mediocrity of speed of decision. These distinctly recognisable groups comprise 4%, 1%, and 8%, respectively, of the total number of students tested.

The degree to which the positions of the less pronounced individuals were interchanged from fast to slow and to middle groups in the various tests can also be determined readily by observation of the circles on the score sheet. A significant question which such a determination answers, for instance, is the following: Did the two persons who fell below the upper 20% in only one test fall way down into the slow group in that test? The same question is answered at the same time with respect to those who were high in all but two tests, all but three tests, etc.; and also the places taken by those who were low in all but one test, all but two tests, etc., can be determined. The answers are tabulated in the following manner. The table really constitutes an analysis of the correlations. It shows the fluctuations in position of individuals at the various grades or levels of possession of the trait. The

first line, if written out completely, would read as follows: 100% (2 individuals) of the 2 who were high in 5 tests (in all but one test) were mediocre in that one test.

TABLE SHOWING FLUCTUATIONS IN POSITION

High Groups.

100 % high in 5 tests are mediocre in 1 test.

100 % high in 4 tests are mediocre in 2 tests.

80 % high in 3 tests are mediocre in 3 tests.
10 % high in 3 tests are mediocre in 2 tests; low in 1 test.
10 % high in 3 tests are mediocre in 1 test; low in 2 tests.

57 % high in 2 tests are mediocre in 4 tests.
29 % high in 2 tests are mediocre in 3 tests; low in 1 test.
14 % high in 2 tests are mediocre in 2 tests; low in 2 tests.

43.3% high in 1 test are mediocre in 5 tests.
40 % high in 1 test are mediocre in 4 tests; low in 1 test.
13.3% high in 1 test are mediocre in 3 tests; low in 2 tests.
3.3% high in 1 test are mediocre in 2 tests; low in 3 tests.

Low groups.

100% low in 5 tests are mediocre in 1 test.

100% low in 4 tests are mediocre in 2 tests.

94% low in 3 tests are mediocre in 3 tests.
6% low in 3 tests are mediocre in 2 tests; high in 1 test.

60% low in 2 tests are mediocre in 4 tests.
20% low in 2 tests are mediocre in 3 tests; high in 1 test.
15% low in 2 tests are mediocre in 2 tests; high in 2 tests.
5% low in 2 tests are mediocre in 1 test; high in 3 tests.

30% low in 1 test are mediocre in 5 tests.
44% low in 1 test are mediocre in 4 tests; high in 1 test.
22% low in 1 test are mediocre in 3 tests; high in 2 tests.
4% low in 1 test are mediocre in 2 tests; high in 3 tests.

This table repeats facts, but it serves to make a few more assertions possible. It is really not only the meagre 4% (6 individuals) at the top of the scale, and the 1% at the bottom of the scale, who show constancy of speed in decisions. Inasmuch as the table shows 100% clear from slow decisions in both the group of 2 individuals who were high in 5 tests and the group of 6 individuals who were high in 4 tests—in the first two rows of the table—, it might be regarded as no great

distortion of fact to include the latter 8 individuals with the 6 of the upper group who are characterized by general constancy of speed. This raises the percentage of individuals who may be called truly speedy in decision to about 10%.

On the same considerations the slow group may be extended to include two more groups who showed 100% clear from fast decisions, and the percentage of truly slow individuals may be raised from 1% to about 13%. Further extensions than these would certainly not be justified by the facts shown in the table.

Conclusions

Correlations between test results are positive and fairly high, indicating that individuals who are quick in decisions of one kind tend to be quick also in decisions of other kinds. This does not constitute a demonstration of high degree of constancy of speed of decision, however, as later qualifications show. There is little likelihood that any one or two tests can be developed to measure the trait adequately. Whether or not this small battery of six tests may serve as a fair measure is not ascertained, and it remains an inviting inquiry.

In corroboration of Bridges' observation, to the effect that those persons quick in subjective decisions are not always quick in objective decisions, it is found that the correlations between speed in the two objective decisions and all others are lower than those between any of the other subjective decisions and the rest. Most constancy of speed (the highest correlation) is found between the two objective tests.

Percentile classification reveals three groups of individuals with whom a certain degree of speed of decision seems to be constant. The groups are very small, however. By lenient extension of classifying boundaries, the group which may be regarded as constantly speedy in decision (according to these tests) comprises 10% of the total number of students tested. 8% of the total number are constantly mediocre, and about 13% show constancy in slow decision. Strictly speaking, only 4% appear dependably fast, 8% mediocre, and 4% regularly slow.

A general criticism of the group testing situation should be added as an interpretation of the results obtained. The experience with individual tests of this same trait, with the tests on Self-assurance reported in the preliminary study, served to make the group testing situation appear unsatisfactory in several respects. The group test introduces an uncontrollable and undesirable factor of competition (not usual in the deciding-situations of life), and it reduces all

tests to a level of similarity to some extent, thus encouraging high correlations.

These two factors are probably more influential in determining these correlations than would appear to the observer not acquainted with the finer advantages of the individual test situation. With regard to the factor of competition, very clearly the rush to beat one's neighbor, or, disregarding the social influence as a disputable item, the rush against time, which is undeniably operative, makes of the test a measure of something more complicated than its name implies. One's decisions under stress of that kind are doubtfully like those (in speed) which one ordinarily makes. The instructions, the admonitions regarding the need of careful judgments, which are given to offset the adjustment favoring speed, only complicate matters. To the less suggestible and the more competitive belong the spoils.

The particular advantage of the individual test in this respect is the possibility of presenting the material in a manner, so that the subject may be kept ignorant of a time element in the test. Unless the essential feature of natural time-rate of decisions is kept in the situation a test cannot very well be said to measure natural time-rate of decisions. Yet that, it seems, is what we mean when we speak of speed of decision.

The other disturbing condition in the group testing situation is not an inherent obstacle to the success of group tests of speed of decision as the other factor is, but it is possible that its influence operated to some extent on the results of this investigation. For here was an attempt to present under a single cover, and in rapid succession, at the same sitting, and under the very same conditions of mood and motion, sets of problems for decision, whose principal value was supposed to lie in their variation from each other. At least, the correlations of the responses were to determine whether decisions of a variety of kinds tended to be elicited at relatively constant or variable speed from the same individuals. Surely, if the situations were identical in some such fundamental respect, any characteristic of the separate tests, or of the deciding activities responding to the tests, which might favor or incline toward variability, would be much reduced in effect. This possible influence is mentioned only as a reminder of the very doubtful character of the correlations found. They are not high as they stand, but if this similarity of conditions had been avoided in some way, so that the true nature of varied decisions had gained expression, it is possible that a greater degree of inconstancy would have been demonstrated.

Summary

1. Fair positive correlations show some constancy of speed of decision.

2. The difference between objective and subjective decisions is reflected in the correlations. Those persons quick in one type are less apt to be quick in the other type than in other decisions of the same type.

3 The large majority (fully 69%) of individuals tested cannot be classified as either quick, slow, or mediocre. They are too inconstant. Only 10% may be characterized as quick, 8% as mediocre, and 13% as slow, according to these tests.

4. No single test differentiates these relatively constant individuals from those whose scores fluctuate from extreme to extreme in the various tests.

5. Group tests have inherent disadvantages for measuring this trait, or for improving theoretical insight into its nature.

Capitulation

1. Logical analysis of Self-assurance reveals Over-estimation as an element which seems to be particularly amenable to experimental test.

2. Two tests are reported, which were tried and found to possess certain advantages for observation of tendencies to over-estimate. They also provide measures of natural speed of decision.

3. The trait of self-assurance, according to evidence of its nature gained by application of a big variety of tests, is still too imperfectly defined to enable the adequate testing of the tests by definite check against objective criteria. (The criteria are not determined.)

4. Development of a servicable criterion in the form of accumulated estimates, to aid which a rating scale was supplied, was successful in the matter of securing reliable estimates, but complexities of the trait, again, deprive the estimates of value as a criterion. Hence

5. The classification of specific forms of self-assurance and development of tests for each separately, is suggested as an improvement upon the attempt to deal with the trait in general. As criteria, then, either objective and directly measurable expressions of the trait may be discovered, or more useful estimates will be obtainable—estimates which shall definitely bear upon the features which the test seeks to measure, and upon these alone.

6. Speed of decision is probably not a reliable indicator of self-assurance.

7. Inconstancy in speed of decision is demonstrated to be the characteristic of the majority of students tested. Constancy seems clearly to be the exception rather than the rule, even under conditions favoring constancy.

8. Speed of decision is not likely to be measured by any one test or by a few tests, excepting in individuals of proven constancy.

9. Group tests have inherent disadvantages for measuring speed of decision, or for improving theoretical insight into the nature of the trait.

PSYCHOLOGICAL NORMS AMONG UNIVERSITY FRESHMEN

By Anna Kellman Whitchurch

This investigation was made at the psychological laboratory of Northwestern University during the year 1916-1917. It was undertaken for the purpose of finding whatever correlation may exist

(1) Between the results in the performance of certain psychological tests, and the mental ability of Freshman students as shown in the attainment of grades in Mathematics;

(2) Between the grades in Mathematics and the ability of the Freshmen as shown by the quarter of the High School class from which they came;

(3) Between the grades in Mathematics of the Freshmen and their instructor's independent judgment of their intelligence.

Description of Tests Used in the Present Investigation

The tests we used were (1) Easy Directions Test,[1] (2) Hard Directions Test,[2] (3) African Proverb Test, (4) Substitution Test.

We used the easy directions test first, and its sections were pasted together in such a way that forty continuous directions were given. The directions were not numbered, however, as they are in the plate.

The hard directions test followed that. This was given exactly as Woodworth and Wells used it.

The African proverb test was arranged in the laboratory of Northwestern University. The object in view was to develop a system of simple tests by which to gain an insight, if possible, into students' capacities for grasping differences and similarities in abstract problems.

The substitution test has been used often in one form or another. The form devised by W. F. Dearborn and described by Whipple, "Manual of Mental and Physical Tests," Part II, p. 136.

[1] Woodworth and Wells Tests No. 88071B, Stoellting.
[2] Woodworth and Wells Tests No. 88071, Stoellting.

Subjects and Method of Investigation

The Department of Mathematics allowed one hundred Freshmen who were taking Mathematics AI to devote the time of one class period to the business of taking the tests. They, together with a class of sixty Sophomores and Juniors, met in a large auditorium. The chairs had desk arms, and each student was provided with a lead pencil in order that all conditions of work might be as uniform as possible. Four professors from the Department of Psychology, three from the Department of Mathematics, and seven members of a Psychology Seminar assisted in giving these tests.

All the test blanks were marked on the back with a check at the top. Those who passed the blanks passed them face down but with the check mark in the correct place. As soon as the papers were received by the subjects they wrote their names and addresses on the back. The papers were left face down until all instructions were given. Then the subjects were told to grasp the paper at the bottom in such a way that it could be conveniently turned. At a given signal the papers were turned, and at the word "begin," the tests were started.

When the time for a test was up, the completed papers were passed along the rows of seats to the right. The papers for the new test were passed in the same direction, so that a minimum amount of time was lost in the mechanics of getting the papers collected and passed. This made possible the giving of the four tests mentioned above and the following tests by another experimenter, in slightly more than an hour's time: two opposites tests, two completion tests, and an information test.

With so many helpers the amount of unfair work among the subjects was reduced to a small per cent. On the whole, we felt that the results were as good as could be gained from the ordinary group test. For the most part the subjects entered into the tests seriously and tried to make them worth while.

The directions for each test were given orally as follows:

1. *Easy Directions Test*

"On the other side of this paper you will find forty simple directions to follow. They are like these, I have on the black board.

"a. Add one dot to the largest group.

. . . . . .

"b. Write any number smaller than 16.

"You are to work as rapidly as possible; for you will have only a minute and a half in which to do this test. The test is so simple that you will not be likely to make mistakes. However, work for accuracy as well as speed. Are there any questions? Start as soon as you are told to begin, and stop immediately when you are told to stop. Ready—turn papers—begin." The stop watch was started at the word "begin."

2. *Hard Directions Test*

"This test is like the one you have just finished, save that the directions are harder to follow. There are fewer of them, and you will have a minute and a half in which to work, as you did before. You will be more likely to make mistakes here; so pay more attention to accuracy, but work as fast as possible. Ready—turn papers—begin."

3. *Proverb Test*

The following diagram was put on the board:

English	African
( ).....	1.....
( ).....	2.....
( ).....	3.....

"You will find on this paper two columns of proverbs arranged as in this diagram—a column of English proverbs on the left, and a column of African proverbs on the right. The African proverbs are numbered; the English proverbs have empty parentheses beside them. You are to turn your paper, read the directions at the top and follow them. Work carefully; for one mistake will count much against you. Are there any questions? Ready—turn papers—begin."

Three and a half minutes were allowed for this. The results showed that that time was too long; for more than half finished the test. This fact will be discussed later.

4. *Substitution Test*

"At the top of this paper you will find nine circles, each containing a number and a symbol. (This was illustrated.) Below, you will find two columns of figures of five places with five empty squares arranged horizontally beside them. You are to write in the squares the symbols corresponding to the numbers as given in the circles above. Finish each number before you start the next. Finish the first column before you start the second. You will have four minutes in which to do this. Every thirty seconds I shall say 'Mark,'

and you are to put a diagonal mark at the exact place where you are then working. This will enable us to find your improvement from time to time. Are there any questions? Ready—turn papers—begin."

Method of Scoring Tests

In the Easy Directions Test there are forty directions to be followed. The record of speed was made by counting the number of directions followed. The accuracy was figured on the basis of the number done.

$$\frac{\text{Number of errors}}{\text{Number done}} = \text{Acuracy}$$

The Hard Directions Test had approximately twenty-one directions, and it was scored in the same way as that used for the Easy Directions Test.

The Proverb Test was scored for speed by counting the number done, and accuracy was found by counting off 12½ for each proverb placed incorrectly.

In order to secure the results in speed in the Substitution Test, one was counted for every square filled. A record was made of what each person accomplished in the eight periods of thirty seconds into which the time for the test was divided. So few errors occurred that they were negligible. The improvement which each person made was found by subtracting what was accomplished in the first two periods from what was accomplished in the last two.

The records for all the tests were then placed on cards, one card for each individual and his records. An example is given on the next page.

The records for each subject in all the tests were ranked, and the rankings placed in red ink above the first records. This was done that the Spearman formula might be used in correlating the tests. The rankings of each person in each test were then added. These results were ranked and formed the general intelligence record. Placing the records on cards in that way, facilitated the ranking to a great degree, because each record was easily moved from place to place. All the data, too, for each person was eventually on one card. This made the records easy to use and easy to refer to.

Specific Errors

We shall now discuss the errors made in response to the four tests respectively. Many of the errors in the Directions Tests were due, of course, to hasty reading.

Freshman		
Smith, Mary		
	Speed	Accuracy
Easy D.	40	5
Hard D.	21	24
Proverb	7	14
		Improvement
Substitution	147	12
Combined Ranks	405.5	

Sample of card used in recording results in tests. Speed = number of directions finished, proverbs placed, and squares filled. Accuracy = per cent of error in completed work. Improvement = number of spaces filled in last two periods minus number filled in first two. Combined Ranks = rankings in all the tests added together.

In the Easy Directions Test there were surprisingly few errors. Thirty-nine people made mistakes, and altogether there were fifty-seven errors made. Twenty-six people made one error each; ten made two each; two made three each; and one made five errors. In speed these people ranked well in comparison with the others tested. Those having one error ranked from 5½ to 96. The former had completed twenty directions and the latter thirty-seven. Those who made two errors ranked in speed from 11 to 100. The former had completed twenty-two directions; the latter had finished all forty. Those having three errors ranked from 29½ to 38. The one person who made five errors ranked 79½ in speed.

The errors taken in order are as follows:

In No. 3, one person placed the number 9 instead of 2 in answer to the question: "How many ears has a cat?"

In No. 5, instead of a cross, two people merely put a line through the word *hat*.

In No. 6, one person wrote out the word eight, and another put figure 8 at the thick part of the line.

In No. 7, two people wrote a word of one letter.

In No. 8, four people put a cross in one of the squares instead of a dot; one put a dot in all the squares; one put a cross in one, and a dot in another.

In No. 9, one person crossed out all the words.

In No. 11, one person drew a curved line like a hill; another connected those given so that a hill was formed.

In No. 12, six people said there is one *t* in *twist*.

In No. 13, three people crossed out the undotted line; one put a dot in the center; and another dotted and crossed it.

In No. 14, seven people wrote o above instead of after the larger number.

In No. 18, one person crossed out the middle square.

In No. 19, one person put a larger number instead of a smaller one after 10.

In No. 21, one person underlined the *g*.

In No. 22, one person wrote *z* above the dots; one put a dot between.

In No. 23, two people said 12 feet make a yard.

In No. 25, one person put a dot above the line.

In No. 26, two people multiplied instead of adding the numbers; one simply rewrote them.

In No. 27, one person rewrote the whole word *John*.

In No. 28, four people dotted the circle.

In No. 29, one person wrote *F*, and another wrote *C*.

In No. 32, one person crossed out the egg-shaped figure.

In No. 33, two people made only one dot.

In No. 35, two wrote *N* instead of *e*.

Some of these errors are alike and may be accounted for. The errors in No. 5, where the lines were drawn instead of crosses made, were probably due to the fact that the direction just preceding called for a line to be drawn. Then, in No. 8, where five people put a cross in the white square, the error was probably made because a cross had been asked for just previously in No. 5, while no dots as yet had been called for. The largest number of errors made in any one direction occurred in No. 14, where seven people put the 0 above instead of after 86. This was probably because in the preceding direction they were asked to put a dot above the line. In No. 28, four people put a dot instead of a cross in the circle. This undoubtedly was due to the fact that in No. 22 and No. 25 dots had been called for. In No. 32, one person put a cross in the egg shaped figure, probably because No. 31 had called for a cross.

These errors seem to show the influence of the preceding actions. The memory seems to have been carried over and to have inhibited the new reaction.

In the Hard Directions Test sixty-two people made errors; and one hundred and twenty errors were made altogether.

Thirty-four people made one error each; ten made two; nine made three; seven made four; one made five; and one made six. The rankings in speed of those making one error ranged from 4 to 89½. Those making two errors ranged from 4 to 89½. Those having four ranked from 7 to 89½. The one having five ranked 89½, and the one having six had that ranking also.

The errors in each direction were as follows:

In No. 1, two errors were made. One person drew a line above one letter, and another dotted all of them.

In No. 3, two people said Christmas comes in March.

In No. 4, fourteen answered correctly, but in answer to No. 5 ten of them crossed out their answers, showing that the next direction was incorrectly followed. One wrote nothing, and one said the sun rose in the west.

In No. 6, fourteen said a horse has two feet; one left the space blank.

In No. 7, three wrote, "NO."

In No. 10, thirteen left this blank, and one wrote, "Yes."

In No. 8, three gave the correct number of days.

In No. 11, four left this blank.

In No. 13, five made a square, and one made a cross.

In No. 14, one person made two crosses, and one made one.

In No. 15, one wrote 6; one wrote 1000; one wrote 1076; two left it blank.

Six people left No. 16 blank.

Eight said that nights in summer were longer than in winter.

In No. 19, one answered incorrectly.

Two wrote 12 in No. 20.

In No. 21, sixteen people wrote the letters in the wrong place or else wrote the wrong letters.

The mistakes in this test were due clearly to misreading and confusion. There is nothing about the errors made to show that the effects of one process are carried over to the next.

In the Proverb Test, forty-one people made errors, and eighty-four errors were made. Twelve people made one error each; nineteen made two; six made three; and four made four.

Those who made one error ranked from 3½ to 62 in speed. Those who made two mistakes ranked from 1 to 62. Those who made three errors ranked from 19½ to 62; while those making four also ranked from 19½ to 62.

In No. 1, no one made an error.

In No. 2, seventeen errors were made. No. 5 of the African Proverbs was given for its equivalent in meaning six times; No. 2 was given eight times; No. 7 once, and No. 3 twice.

In No. 3, four errors were made. No. 2 of the African Proverbs was given for its equivalent three times; No. 3 was given once.

In No. 4, sixteen errors were made. No. 4 of the African Proverbs was placed here seven times; No. 6 five times; No. 1 twice; No. 3 once.

In No. 5, fifteen errors were made. No. 3 of the African Proverbs was given as its equivalent nine times; No. 5 three times; No. 6 once; No. 4 once; No. 2 once.

In No. 6, seven errors were made. No. 6 of the African Proverbs was given as its equivalent twice; No. 3 twice; No. 7 twice; No. 4 once.

In No. 7, there were eleven errors. No. 1 of the African Proverbs was given as its equivalent four times; No. 3 four times; No. 5 once; No. 2 once, and No. 6 once.

In No. 8, fourteen errors were made. No. 7 of the African Proverbs was given as its equivalent eleven times; No. 2 once; No. 5 once; No. 4 once.

No. 3 of the African Proverbs was misplaced nineteen times. No. 7 was misplaced fourteen times.

In the Substitution Test few errors were made. Three people did not mark the thirty-second periods as the signals were given. One person worked across the page instead of down the first column and then down the next.

The Spearman Foot-Rule Formula was used to obtain the correlations. The formula is

$$R = 1 - \frac{6 \Sigma G}{N^2 - 1}$$

R stands for index of Correlation.

ΣG stands for the sum of the numerical gain in rank of the individuals in the seconds, as compared with the first series of the results which were correlated.

N stands for the number of individuals in the series.

The 4 was obtained by the use of Thorndike's table, which converts R into the Product-Moment equivalent r. Thorndike's formula for so converting R is

$$r = 2 \cos \frac{\pi}{3} (1\text{-}R) - 1$$

Following are the correlations between the results of the various tests:

Easy Directions and Hard Directions (Speed)	.70
" " " " " (Accuracy)	.33
Easy Directions and Proverb (Speed)	.42
" " " " (Accuracy)	.33
" " " Substitution (Speed)	.52
Easy Directions (Accuracy) and Substitution (Improvement)	.36
Hard Directions and Proverb (Speed)	.36
" " " " (Accuracy)	.36
" " " Substitution (Speed)	.36
Hard Directions (Accuracy) and Substitution (Improvement)	.00
Proverb and Substitution (Speed)	.32
Proverb (Speed) and Substitution (Improvement)	.25
General Intelligence and Easy Directions (Speed)	.71
" " " " " (Accuracy)	.32
" " " Hard " (Speed)	.72
" " " " " (Accuracy)	.32
" " " Proverb (Speed)	.54
" " " " (Accuracy)	.55
" " " Substitution (Speed)	.48
" " " " (Improvement)	.44

Estimated Abilities

We obtained an estimate of the natural ability of each student from the Professors in Mathematics who had under their instruction the Freshmen who had been tested. The following instructions were given to them:

So far as you are acquainted with the following persons, mark down after each name a number indicating the intellectual fitness of each individual. Grade in terms of what you consider their real ability or capacity to do difficult intellectual work—not in terms of their customary class performances.

Mark	+ 2	after	superior individuals
"	+ 1	"	very good "
"	0	"	merely average "
"	— 1	"	just below " "
"	= 2	"	very poor "

In that way an estimate of the ability of all but four of the hundred was obtained. Each professor was asked to make as nearly as possible a distribution corresponding to the following: Out of ten pupils, four would rank at zero, two at +1, one at +2, two at —1, and one at —2. The professors' estimates are shown in Table I, pp. 328-329.

From the high schools where these students had graduated, we learned whether these people had been in the first, second, third or lowest quarter of their class at the time of graduation. We obtained the desired information from all but seventeen high schools. The other ranks are given in the third column of Table I.

Arrangement of Results in Table

The group of one hundred Freshmen was divided into four quarters. The results of the tests were arranged in order of attainment when all the ranks of each student in the tests were added together. These are given in Column 1, Table I. Thus the first quarter has the twenty-five who did the best work in the tests; the next quarter has those who came next to them; the third and fourth quarters are arranged accordingly. The next column, No. 2, contains the estimates of the professors upon the abilities of the students in question. In the next column, No. 3 are their respective positions in the high school class with which they graduated. In the last column, No. 4, are the grades obtained in Mathematics. These grades were given in terms of A, B, C, D, F,—A being the highest possible grade, and F denoting failure in the subject. For convenience's sake, these grades are given in the table as 1, 2, 3, 4, 5,—1=A, 2=B, etc.

The following correlations were made between General Intelligence as found in the combined results of the tests, the grades in Mathematics, the estimates of ability by the professors, and the quarter of the high school class in which they were placed:

General Intelligence	and	Mathematics' Grade	=	.24
" "	"	Professor's Estimate	=	.22
" "	"	High School Quarter	=	.36
Mathematics Grade	"	" "	" - =	.55
" "	"	Professor's Estimate	=	.92
Professor's Estimate	"	High School Quarter	=	.59

The following table is divided into four quarters according to the respective rankings in the tests. The second column gives the professor's estimates; the third gives the High School Quarter from which the students came; the fourth gives the Mathematics grades.

TABLE I

FIRST QUARTER

	Sum of Ranks In Tests	Prof. Est. Terms of +2, +1, 0, −1, −2	H. S. Quarter	Math. Grades
1	614	+2	1	1
2	597	+1	1	1
3	572	+1	1	2
4	567	+1	3	4
5	558	+2	1	1
6	557	+1	1	2
7	533.5	−1	1	4
8	528	+2	1	1
9	526	+1	1	2
10	525.5	0	4	3
11	525	+2	1	1
12	523.5	+1	1	2
13	521.5	+1	.	2
14	520	+1	2	3
15	517.5	+1	.	2
16	514	−1	1	2
17	511	−2	4	5
18	510.5	+1	1	3
19	504.5	0	.	3
20	503.5	−2	2	5
21	503.5	0	1	3
22	496	−1	3	5
23	496	−1	.	4
24	493	...	.	.
25	488	+1	1	3

SECOND QUARTER

	Sum of Ranks In Tests	Prof. Est. Terms of +2, +1, 0, −1, −2	H. S. Quarter	Math. Grades
26	483.5	+1	1	2
27	483.5	...	.	.
28	480.5	0	2	2
29	480	+1	4	1
30	477.5	0	2	4
31	472	0	1	2
32	467.5	0	1	3
33	462	−1	.	4
34	461.5	0	2	3
35	461.5	−2	1	5
36	461	0	4	1
37	458.5	+2	2	1
38	453	−1	4	5
39	450.5	+1	1	2
40	440.5	0	1	3
41	440	0	3	2
42	435.5	−2	.	5
43	427	+1	2	2
44	425	−2	1	4
45	423.5	0	1	3
46	422	−2	2	4
47	421.5	0	3	2
48	415.5	+1	1	2
49	414.5	−1	4	5
50	412.5	0	1	3

TABLE I—Con.

THIRD QUARTER

	Sum of Ranks In Tests	Prof. Est. Terms of +2, +1, 0, −1, −2	H. S. Quarter	Math. Grades
51	412.5	0	1	3
52	408.5	0	2	3
53	403	+1	1	2
54	403	0	4	3
55	401	−1	1	3
56	396.5	0	3	3
57	395	−1	.	4
58	395	0	1	3
59	394.5	−1	2	4
60	388	+2	1	1
61	380.5	+2	1	1
62	377	0	.	3
63	374.5	+1	1	3
64	368	0	2	3
65	367.5	−2	4	5
66	367	+1	1	2
67	365.5	+1	2	2
68	364	+1	2	3
69	356.5	0	2	3
70	345	...	.	.
71	340	−1	3	4
72	338.5	+1	1	2
73	332	−2	4	3
74	332	+1	1	2
75	331	0	.	3

FOURTH QUARTER

	Sum of Ranks In Tests	Prof. Est. Terms of +2, +1, 0, −1, −2	H. S. Quarter	Math. Grades
76	324.5	+1	1	2
77	324.5	+2	1	1
78	318.5	−1	3	5
79	318.5	+1	2	2
80	313	+1	2	1
81	311	0	1	3
82	310	+1	.	3
83	303	−1	1	4
84	293.4	+1	1	3
85	291	+1	4	2
86	284	−1	3	5
87	283	...	.	.
88	275	+2	1	1
89	269.5	+1	1	1
90	262.5	−1	.	5
91	245.5	−2	1	5
92	240.5	−2	.	5
93	238	0	3	3
94	238	−1	1	5
95	203.5	0	1	3
96	201.5	0	1	3
97	196.5	+1	2	2
98	184.5	+1	3	2
99	161	−2	4	5
100	144.5	−2	4	5

In order to see, if possible, the difference in mental ability between those who ranked highest and those who ranked lowest in the tests, it was decided that three from the top and three from the bottom should be tested individually. Results for only two at the bottom were obtained. The tests used for this purpose were: Healy Puzzle Box; The Dutch Homestead (test for memory of ideas from Whipple's Manual); a Part-Whole and a Genus-Species test.

The next table shows the results obtained. The numbers in the first column correspond to those in the first column of the quartiles in Table I.

The column entitled "Steps" under the Healy Puzzle Box Test shows the number of steps necessary to open the box. A perfect performance is six. Under "Time," the number of minutes and seconds required are shown.

The columns devoted to the Dutch Homestead show the number of words and ideas recalled. In the test there are one hundred and eighty words and ninety-four ideas. The median reaction time is given for the Part-Whole and Genus-Species tests.

TABLE No. II

	Healy Puzzle Box		Dutch Homestead		Part-Whole Median Reaction	Genus-Species Median Reaction
	Steps	Time	Words	Ideas	Time= Seconds	Time= Seconds
1.	23	5′ 57″	159	47	2.2	2.3
2.	10	2′ 31″	94	25	2.6	1.6
3.	17	3′ 50″	67	27	2.7	2.2
98.	8	1′ 54″	135	32	3.3	4.25
100.	17	4′ 42″	106	27	2.0	2.5

The results from the above do not correspond with the results of the first set given. For instance, the man who was number 98 in the first series used the fewest steps and least time in opening the Puzzle Box. As the least possible number of steps is six, his performance was almost perfect.

In the Dutch Homestead test the girls who ranked first in the other tests were superior. The other four are nearly alike in the number of ideas remembered, while in the number of words given the two lowest are distinctly better.

The reaction times in the Part-Whole test vary but little. In the Genus-Species test, practically the only variation is between Number 2 and Number 98.

The result hoped for was not obtained. These last four tests show little if any difference between those who rank high in the first tests and those who rank near the bottom

Introspective Data from Tests

There has been, up to this time, too little discussion of the mental capacities or functions that are most active when one is reacting to the tests in which we are interested. There is too little description, too, of methods by which different reactors go about their work. This data can be obtained in part by introspection. This is important because before a test can be evaluated it is necessary to obtain all the information possible about it.

With this in mind, one day around the seminar table, eight people, six advanced students and two professors in psychology, took the tests we had given to the Freshmen. Afterward each one recorded his mental processes while taking the test. These people were experienced in introspection, and it was hoped that we might find some of the frequent ways in which those people tested ordinarily went about their work, and the various mental processes used in doing the tests.

The following are some quotations showing various interesting ways of proceeding with the test material. The first are from the Easy Directions Test.

"I had a feeling of pushing from within or of an effort to get ahead in a short space of time. There was also a feeling of checking myself lest I should omit a line or make another error. My attention was directed rather narrowly to the directions themselves."

The method just quoted is one probably used by many people. The feeling of push would be prevalent in most tests where speed was involved. The next person went about the test in a different way.

"I read rapidly. I did not pronounce all the words, and I am not sure that I even saw them all. I was conscious of trying to understand the direction, and a feeling of surety and satisfaction came with the grasp of meaning. After the meaning came, I waited with gaze fixated on the symbols at the end, and the proper movement of the pencil resulted automatically. When the feeling of meaning failed to come, I consciously repeated parts of the direction or even the whole thing over again. There was consciousness of strain throughout."

The two people quoted seem to represent two groups often seen in Mathematics classes. The one is careful and method-

ical and sure. The other breathlessly grasps an indefinite meaning and automatically works a problem by the first method that comes to mind. He works more rapidly than the first, and though he may make more mistakes, will accomplish as much in the end because of his speed.

In regard to mental processes, the following statements were made:

"The test seems to call for readiness in recalling alternatives. The presence or absence of hesitancy would soon be felt."

"The requirements seemed simple enough until No. 7 was reached. This called for a word of three letters, and I felt like checking myself to see which word might be selected. In No. 11, where we were asked to mark the line which looks most like a hill, I wondered that any of them appeared like a hill. My next notion was that the turning of the paper might make one of them into a hill. I finally chose the third as the one being most appropriate when the paper was in its natural position."

"The figures on the right received the most passive attention except in the cases of No. 6 and No. 11, where I had to discriminate between stimuli. In No. 11 I was puzzled. In no other case did I *consciously* discriminate. It seems to me that the predominant function here is voluntary attention to immediate sensory stimuli."

"No. 10 called for voluntary inhibition. Nos. 1, 2, 4, 6, 8, 11, 13, 16 and 18 called for appreciation of objects. Nos. 5, 6, 14, 15, 19, called for comparison of values. Nos. 3, 7, and 12 called in association. No. 9 required general memory."

All of the above quotations seem to show the required use of attention and apperception. Probably more than any other one thing, this Easy Directions Test does test the function of attention.

Some remarks in regard to the Hard Directions Test follow:

"The words of the instructions continued to sound auditorily-kinaesthetically while the answers were being written. They seemed to determine the proper answers. Occasionally I started to make the wrong answers. Immediately an uncomfortable feeling arose. Pertinent parts of the instructions became more vivid auditorily. With the right answer came a feeling of relief."

"Here I had to keep attention not only on what was passing under my eye, but usually upon what had preceded; and not only that, but I was always in an attitude of expectance also—i. e., toward the future. Consequently I was embarrassed

always by alternating attention between the directions, and I was all the more fearful of making mistakes. There was a feeling of greater effort here than in the Easy Directions Test, where I attended only to what was passing under my eye."

"This test required perpetual attention. A perception organized into a very definite appreciation or apperception of what was wanted in each case was necessary. This was different from the easy test and noticeably more difficult in that a constant resistance to suggestion was required throughout. Imagination seemed to play no part here. Memory was not so much involved since the facts called for were of a triflingly common nature. But power to command this knowledge instantly and without forewarning and to write it as quickly as it was thought was needed."

"Reasoning was most used in this test, as many times reasoning compelled me to do the opposite from what memory suggested as being correct for certain of the questions. All the time I felt that I would have to be careful lest the simplicity of the questions as asked would lead me to erroneous answers. The feeling of caution was present."

"There was present inhibition to respond in the usual way. This sometimes in the first reading led to closer attention. Often I tended to the wrong answer, but stopped to compare my knowledge with the suggestion made on the paper."

At once we wonder what the effect of the various reactions called forth in individual subjects would have upon the speed and accuracy of their performance. In the Easy Directions Test the close attention which was mentioned several times would surely lead to accuracy, and would probably steady the rate of work. In the case of the man who waited automatically for the answer to come to his pencil, one might suppose the process of answering to have been subconsciously done. While this might accelerate speed, it would be apt to block accuracy.

In the Hard Directions Test, the subject who held his attention closely to the direction upon which he was working, to the one preceding that, while consciously alert for the one about to come, probably made no mistakes, and his speed would be greater than the one who read carelessly and hurriedly and so had to go back. The fact that answers were called for contrary to one's usual line of thought would decrease speed and lay one liable to errors. The constant alertness and caution necessary to overcome that would make for accuracy, but would probably decrease speed. In short, any-

thing purely automatic could be very rapidly accomplished. Those directions calling for caution, reason and discrimination would cause delay.

To proceed to the Proverb Test:

"My consciousness of the directions seemed to be summed up in a visual kinaesthetic feeling of putting numbers in brackets. I read through an English proverb without getting a clear comprehension of its meaning—i. e., I did not translate it into other terms or apply it mentally to any concrete situation. Nevertheless, I proceeded immediately to glance hastily through the African proverbs. I rushed up and down the list in great haste without attempting to read one of them through, and without system, until I struck a phrase or turn of words that 'felt right.' Then I automatically put the number in the brackets. The consciousness of agreement between the meanings was a vague process."

Another wrote, "The first time I undertook this test I was embarrassed by the Directions. The nature of the test had not been adequately explained to me. I wanted to make speed, but I had to look into the proverbs to understand the directions. Then the truth flashed over me that I was adding time to my record. I was embarrassed, and because of that I started under a handicap. When I was ready to go at the work I followed this method: I fixed the first English Proverb in mind, and then read through the African proverbs comparing each with the meaning of the English proverb. After selecting one fitting its meaning, I proceeded the same way in each other case. In each case the proverb suggested a visual image, and I found myself looking for a common or near common element in these images and comparing them. When once I was ready to write the desired numbers beside the English proverbs I had the feeling of having solved a problem. The ability called for here seems to be that of handling imagery more or less abstract."

One student used the method described above, but instead of reading an English proverb first, he selected an African proverb and searched for one of like meaning in the English column. After describing his method he says: "But with many of the African proverbs I felt that the meanings were too ambiguous ever to admit of close comparison. Continued thinking and reasoning led me to believe that I had stressed the details too much, and that I should select that larger meaning of each proverb and adhere to that for comparative purposes."

Another says: "The process is one of *comparison* analagous to that of *superposition* in geometry. Superposition here is one of ideas rather than symbols. Selection of the correct parallel proverb is a matter of assembling all the African ones not yet used as possibilities. Next, the irrelevant ones must be rejected. In carrying on the process of selection, the one proverb has to be borne in mind as the problem or end in view."

Here again we have two types of individuals, the one who hastened to read here and there in the two columns, and the one who conscientiously and carefully read and compared one proverb with the others. In the final results one type did as well as the other. It would seem from the descriptions we received that much the same process was carried on as that used in solving a problem in mathematics. It was necessary first to analyze a proverb and retain its abstract meaning. Comparison of one abstract meaning with another was necessary all the way through. The final selection would adequately compare to the solution of a problem. The mind acting accurately in this situation would doubtless do equally well with a mathematics problem.

Some of the remarks on the Substitution Test follow:

"The feeling that I should need to remember the symbols later led me to try to impress them upon my mind. It was soon found to be economical to try to memorize the easier symbols. An association helped in fixing the symbols. For instance, I thought of 7 as △ incomplete and up-side-down."

Another says he made no conscious effort to remember. He simply relieved memory of that strain and allowed a habit to form. He had to inhibit the desire to place one symbol for another that had just been used.

A unique way of doing the test is described here: "The first time I tried this test I did not play the rules of the game, but read the number, held the digits in my mind's eye and then hunted for the necessary symbols in succession. These symbols I was soon able to write in the squares without looking at the squares. No attempt was made to learn the symbols, and they were not learned at all well. I had their location in mind much as a typist has in mind the location of the keys. Primary memory for the numbers seems to be the only mental function I employed. Later I found the real learning of the symbols more difficult. Primary memory for the whole "key board" was finally acquired, largely by aid of imaginary association in which I imagined houses, trees, etc., in a yard standing for the symbols respectively."

The way this man did the test the first time may have been duplicated by members of the Freshman group who were tested. In that case accuracy would be perfect, and speed would range high. The test would not be one of learning at all. It would test rather primary memory and motor facility.

The next person made it a real learning test. He says: "I kept my eyes on the key as much as possible and filled in the spaces without looking. I read each individual digit separately and then looked at the key. At first it was necessary to hunt consciously for digits in the key. Gradually the proper digit with its symbol would tend to jump out from the key as a whole; i. e., I would tend to turn directly to the proper place in the key. Occasionally when I got lost I hunted up and down the key board without taking in much of it. As learning progressed, the symbols for the different numbers became consciously recognized and identified when found. The ability to find them quickly seemed to be correlated with this fact that the symbols were getting learned."

One student said: "The power to form visual images rapidly and accurately seemed to come into play. After writing two numbers, it became easier to 'See' the proper symbol mentally as soon as the digit was read than to look back to the heading. To people whose memory images are other than visual, I believe this would be a difficult test, and could be done only slowly."

As in this case, visual imagery would assist greatly in the test, but motor imagery might be quite as adequate.

From this introspective data we find the predominant mental functions used in these tests to be: active attention, response to immediate sensory stimuli, discrimination, comparison and selection, and association. Looking back at my own experience in mathematics, I would say that these functions played a large part in solving problems. It is necessary to center one's attention to analyze and to discriminate in order to come to a solution.

Professor Frank Nugent Freeman in his "Psychology of the Common Branches" tells us that problems are solved by analyzing conditions and following up clues. Before the solution can be obtained it is necessary to get an understanding of the problem in concrete terms. In geometry, for instance, a pupil must thoroughly understand that the lines and angles represent real spacial relations.

This analysis and following up of clues is apparent in the Directions Tests and the Proverb Test. So far as we can

rely upon the introspective data, it would seem that these tests tested the same ability as that which Professor Freeman feels is required by the student in Mathematics.

Discussion of Results

The data gained from those who took the tests for the purpose of introspection seem to show that the tests really tested some of the abilities necessary for successful work in Mathematics. However, the correlation between the results of the tests and the Mathematics grades is low (.24). This may be due to poor adjustment of the students to their work during the first semester of their University course, or it may be that the introspections did not reveal the real abilities tested. If the latter is true, then the tests selected may not test the abilities necessary in work in Mathematics.

On the other hand, it is quite possible that the students tested did not put all of their energy into the tests, and therefore did not do them as well as they might have done. It is impossible to tell just how much attention the subjects did give their work. While they appeared to work hard during each test, they undoubtedly did not put in their maximum attention. Indeed, it is impossible to measure the absolute degree of attention by any laboratory methods at present perfected. This inability to measure attention is a drawback in every phase of laboratory psychology. Granting that the students did not do their best in these tests, while the tests might have got at mathematical ability, the results would not show high correlation.

Three Professors graded the students upon their work in Mathematics. It is unlikely that all three of these have the same standards of grading. Therefore, the grades themselves with which these correlations were made are more or less arbitrary.

Then, again, the tests given individually to those who stand highest and those who stand lowest do not show a very great difference. It is well known that high correlations are not to be expected from a homogeneous group of subjects. Either part do well in those things in which others fail, or all fail and succeed in the same lines, and thus balance the results. This causes the results of the group to fall into a narrow distribution. Our group of subjects were all Freshmen. This pre-supposes a degree of homogeneity. The subjects have all passed the same entrance requirements to begin with. By referring to Table I it will be seen that forty-five of the one hundred are from the first quarter of the high school class

with which they graduated. Granting that some of these classes were small, and that the quarter in which each student was placed was assigned more or less arbitrarily by the principals of the high schools, still the fact remains that forty-five per cent of these students were considered considerably better than the average in their classes. This fact of the homogeneity of the group would account for a relatively low degree of correlation.

The high correlation (.92) between the grades in Mathematics and the professor's estimates of the students' abilities were to be expected. The grades received by the students probably influenced the professors when they gave the estimate, and vice versa.

The correlation between the grades in Mathematics and the high school quarters from which the students came was .55. This was as high as could be expected when we remember that forty-five per cent came from the first quarter.

On the whole, this investigation seems to have been worth while in spite of the fact that the results in the mental tests did not correlate highly with the Mathematics grades. The student who did the best work in the tests was found to be an exceptional student. She received A grades in all her work for the first semester. The student who stood lowest in the first tests failed in all his work. He failed twice in Mathematics, and, after having been tutored privately, failed the third time. Even with the unavoidable difficulties that come up in getting accurate results from mental tests, it would be possible for a teacher to gain some insight into his students' abilities by the use of such tests at the beginning of a semester's work together. This investigation shows a more or less definite connection between the class standing and abilities involved in doing the tests.

Dr. Wissler[3] who made correlations with some of the testing done at Columbia University, felt that the markings in college classes would correlate with mental tests to only a slight degree. Miss Calfee's[4] correlations between the tests she gave at the University of Texas and the average class standing were low. Professor Bell[5] in his work at the same University found his highest correlation between a class standing and the results of a test to be only .31. Miss Rowland and Miss Lowden[6] found a correlation of .25 between grades

[3] *Psych. Rev Mono. Sup.* 3, 1901, No. 6.
[4] *J. of Ed. Psych.* 4, 1913, 223-231.
[5] *J. of Ed. Psych.* 7, 1916, p. 381.
[6] *Jour. of Exper. Psych.*, Vol. 1, No. 3.

in Mathematics and one group of tests. While the results recorded here are much like those we found with our work with Northwestern University Freshmen, still we feel that there is a hopeful outlook. With perfection of methods of giving mental tests, and perfection of a system of grading for class work, the connection between the two will be more evident. When that time comes, the results of mental tests will be an index to the abilities of students in their class work.

Summary

1. The highest correlation in this investigation was .92. This was between the professor's estimates of the students' ability and their grades in Mathematics.

2. The lowest correlation was .0. This occurred between the accuracy in the Hard Directions Test and the improvement in the Substitution Test.

3. Among the tests the correlations ranged from .72 between General Intelligence and Hard Directions Test to .0 between the accuracy in the Hard Directions Test and the improvement in the Substitution Test.

4. The correlations with the Mathematics grades were:

Mathematics and General Intelligence.....	.24
Mathematics and High School Quarter....	.55
Mathematics and Professors' Estimates...	.92

A PRELIMINARY REPORT OF AN EXPERIMENTAL ANALYSIS OF CAUSES OF STUTTERING[1]

By Lewis O. Anderson, University of Wisconsin

Of human afflictions, stuttering is one of the most elusive. Persons who are handicapped by it often find no one who can give intelligent advice or treatment. Many become victims of quacks. Moreover, if we look to various recognized authorities on stuttering we find great diversity in the theories which have been put forward. Repressed "complexes" have been held responsible. Weak imagery has been assumed. The trouble has, in general, been looked upon as mental, but there has also been belief in some defect of physiological coordination. Inherited neurotic dispositions, emotional instability, abnormal fears, trauma, imitation, and many other things which have been present in various cases, are alleged to be causal. Indeed, stuttering has appeared in such an unusual variety of conditions and circumstances, and often with so many complications, that it is not at all surprising to find disagreement as to what the causal factors are. There is a host of scattered hypotheses. Usually several factors are considered operative at the same time. But which, and how many? And which of these are dominant? Definite knowledge is lacking. There have been many scattered observations, but there seems to have been no systematic survey made on the basis of experiments set up to put hypotheses to a test and thus get evidence on a scientific basis.

One important outcome of the numerous observations is a growth of the view that stuttering is not a disease in itself

[1] This investigation has been in progress for two years, being under the authority of the Speech Clinic, University of Wisconsin, of which Doctor Smiley Blanton is the Director. The experiments (at the University of Wisconsin) were performed in a special research room in the psychology laboratory. Professor Joseph Jastrow and Professor Clark L. Hull are to be thanked for their great interest and valuable suggestions. The author is especially indebted to Professor Hull for careful criticisms during the experimental work and in the preparation of the manuscript. The subjects, with speech disorders, for these evperiments were obtained from the following sources: (1) cases at the Speech Clinic, University of Wisconsin, (2) cases at the Speech Clinic, United States Public Health Service Hospital, Wakesha, Wisconsin, and (3) cases at the Wisconsin Industrial School for Boys, Wakesha, Wisconsin.

but only a symptom. If, then, it is not at its root essentially a speech defect, investigation of it must not be limited to vocal reactions. Mental conditions apart from speech must be studied. The purpose of this article is to present briefly some results of a number of special tests designed to detect and measure certain traits in reactions outside of the field of speech, and given in such a way as to show, if possible, whether these traits are definitely associated with stuttering. In view of the large number of alleged causes, this experimental work was planned so as to constitute a survey of significant types of mental and physiological processes which are common to vocal and non-vocal reactions. While there are, no doubt, both innate and external contributing factors, these tests were aimed principally at those which are innate, or at least internal. An essential part of the method consisted in a detailed comparison of groups of stutterers with groups of "normals." Fortunately, it was also possible to include a group of ex-stutterers. At the University of Wisconsin, practically no treatment preceded the tests in these subjects.

The tests whose results are reported here are briefly described as follows:

1—Foot tapping:

If there is a general defect of physiological coordination, it could reasonably be expected to manifest itself in a tapping test, especially if the variability of tapping rate be measured. A foot tapping test was therefore set up in such a way as to get a graphic record of the separate taps.

2—Hand coordination:

It is well known that stutterers talk well under imposed rhythm. A test was then designed for coordination and rhythm in other than speech reactions. The subject went through certain complicated series of arm movements, in some trials following the beating of a metronome, and in other trials simply going as fast as he could.

3—Block test:

In view of alleged weak imagery, this and the two following tests were introduced. This one was devised as a test of memory span for movements. Four small wooden blocks were used.

4—Two-dot test:

This test was aimed to detect weakness in the kinaesthetic field. With eyes closed, the subject made a certain arm movement (making a dot with a pencil on a piece of paper), and about one second later tried to reproduce the movement exactly. He was scored on accuracy of reproduction, judgment

of his error, and on constant error (i. e. tendency to err with the second movement constantly in a given direction).

5—Visual imagery:

A few subjects were given visual imagery tests, some of which, e. g. the Binet Simon clock-test, are well known.

6—Complex reaction-time:

A familiar characteristic of the stutterer's reactions, at least in speech and emotional situations, is instability. He is variable. He goes ahead by spurts. To possibly measure this instability, a typewriter with a device to expose the digits 1, 2, 3, and 4, one at a time in irregular order, was set up in such a way as to get a graphic record of sixty reaction-times in uninterrupted succession.

7—Inhibition:

The characteristic spasms and blocking on words clearly suggest some defect of inhibition. A test was accordingly devised to measure inhibition outside of vocal reactions. A list of numbers in irregular order was read, and the subject was directed to respond by raising his arm slightly every time "3" was read immediately after an odd number but not after an even number. Forbidden responses, and also partially inhibited forbidden responses, were recorded.

Tables I and III summarize typical results of the subjects at the University of Wisconsin. Since certain changes were made in the tests before they were given to the second of these two groups of subjects, the results in the two cases are not always strictly comparable. Table II summarizes results from the boys at the Industrial School at Wakesha. It should be stated that the hand-coordination test and the inhibition test were slightly simplified for the subjects at the Industrial School and at the U. S. Public Health Service Hospital. These results will now be discussed in the order in which the tests appear in the Tables.

An inspection of the results of the first test in Tables I and III shows no consistent difference between the stutterers and the normals in tapping rate. Ex-stutterers, however, are very rapid (Table III). A significant difference[2] exists be-

[2] In order for the difference between two averages to be significant, the difference should be at least 2.5 times its probable error. This probable error is obtained from the probable errors of the two averages by the formula:—

$$P.E._D = \sqrt{P.E._{M_1}^2 + P.E._{M_2}^2}$$

Throughout this article the term "significant difference" thus means one which is at least 2.5 times its P.E. In the above mentioned case it is 3.2 times its P.E.

tween their average and that of the normals. This type of reaction, then, seems to be definitely associated with recovery from this speech defect. As to variability of tapping rate, the improved stutterers have a much lower score than the normals. Obviously, there is no evidence here for any defect of coordination at this level, that is, of the rapid but coarse muscular movements of tapping.

The next test, that of hand coordination, shows a characteristic difference between stutterers and normals. A careful comparison of Table II with Table III will make clear that the stutterers tend to do relatively better when following the beating of the metronome, while the normals tend to do relatively better without the metronome. "No. right" means number of trials passed without error. The results from ten stutterers at the hospital show the same tendency, but taken alone they are not sufficiently reliable for a conclusion. At any rate, it must be noted that the tendency, as far as it appears in these results, is in clear harmony with the well known effect of imposed rhythm on the stutterer's speech. The significance of this is that the trait appears to be general: here it seems to play an important rôle in reactions which have practically nothing to do with speech. If we compare the improved with the unimproved stutterers, another significant difference is found. It would appear from these subjects that the stage of improvement in speech essentially involves a marked disturbance in the types of coordination required in this test. This, however, needs further investigation. As to individuals, one patient who was troubled by being speechless from fear in military situations, did very well in this test and remarked that he had very poor control in e. g. driving a car in tight places. He accounted for his doing well in this test by saying that there was no fear connected with it.

The block test (Table III) shows the stutterers to be distinctly inferior to the normals in memory span for movements. The scores in this test were also averaged separately for severe and mild cases; these averages were respectively 24.1 and 30.4, with a significant difference. The question arises as to what bearing this has on theories of weak imagery. To consider this it is first necessary to ask if this is a test of mere imagery as such or whether it is a test of other functions along with imagery. Memory span tests have been used as tests of attention. What this test really tests is probably the ability to hold several things in mind at the same time. The stutterer here appears to have difficulty in grasping several

TABLE I

SHOWING RESULTS OF THE FIRST GROUP OF SUBJECTS AT THE UNIVERSITY OF WISCONSIN

Test	Type of Record	Normals			Stutterers		
		Cases	Score	P. E.	Cases	Score	P. E.
FOOT TAPPING	Number of taps	18	132.4	3.94	12	121.2	3.69
	Variability (seconds)	18	.19	.011	12	.153	.016
HAND COORDINATION	No. right: Without metronome	[illegible]	.76	....	17	.82	....
	No. right: With metronome	29	1.8	....	17	1.7	....
COMPLEX REACTION TIME	Number of errors	17	3.9	....	16	4.9	....
	Time (seconds)	17	.79	....	16	.79	....
	Variability (seconds)	17	.55	.049	16	.456	.029
INHIBITION	Forbidden responses	15	3.1	....	9	4.6	....

TABLE II

SHOWING RESULTS OF THE SUBJECTS AT THE WISCONSIN INDUSTRIAL SCHOOL FOR BOYS

Test	Type of Record	Normals			Stutterers		
		Cases	Score	P. E.	Cases	Score	P. E.
HAND CO-ORDINATION	No. right: Without metronome	12	.83	....	21	.38	.094
	No. right: With metronome	12	.83	....	21	.76	.14
BLOCK TEST	Number right	13	34.7	1.41	21	27.1	.7
TWO-DOT TEST	Motor accuracy (mm)	11	12.7	.68	20	11.6	.32
	Error of judgment (mm)	11	14.45	1.46	20	15.45	.71
	Constant error (mm)	11	8.8	.83	20	6.2	.4
INHIBITION	Forbidden responses	11	6.55	.89	15	7.93	.59
	Partially inhibited	11	3.55	.48	15	1.8	.22

TABLE III

SHOWING RESULTS OF THE SECOND GROUP OF SUBJECTS AT THE UNIVERSITY OF WISCONSIN

		NORMALS			STUTTERERS						EX-STUTTERERS		
					Unimproved			Improved					
Test	Type of Record	Cases	Score	P. E.	Cases	Score	P. E.	Cases	Score	P. E.	Cases	Score	P. E.
FOOT TAPPING	Number of taps...	39	121.7	2.3	11	128.6	....	10	128.9	....	11	140.3	5.3
	Variability (seconds).....	39	.206	.009	11	.192	....	10	.167	.009	11	.186	....
HAND COORDINATION...	No. right: Without metronome	27	1.11	.085	8	1.37	....	7	.57	....	12	.92	....
	No. right: With metronome	27	.63	.098	8	1.37	....	7	.71	....	12	1.08	....
COMPLEX REACTION TIME	Number of errors.	24	3.87	.368	8	2.12	....	6	2.	....	11	2.73	....
	Time (seconds).....	24	.891	.019	8	.797	.025	6	.879	....	11	.778	.025
	Variability (seconds).....	24	.6041	.031	8	.52	.062	6	.5637	.049	11	.3754	.017
INHIBITION....	Forbidden responses.....	36	3.11	.25	12	2.9	....	9	2.11	.41	13	2.54	....
	Partly inhibited.....	36	4.69	.3	12	3.25	.41	9	4.44	.58	13	3.69	.51

movements simultaneously. The significance of the kinaesthetic factor seems to be that in consciously directed speech movements a great many kinaesthetic elements must be held in mind simultaneously and thus coordinated. This the stutterer is apparently unable to do. To the writer the most logical conclusion seems to be that the trouble lies in the coordination of imagery rather than in mere imagery as such; that the stutterer, especially in certain situations, lacks the ability to coordinate the kinaesthetic and other imaginal elements involved in speech movements when they appear in large numbers simultaneously.

In the two-dot test the only significant difference found between the stutterers and the normals (Table II) was in "constant error," the stutterers having the lowest score. Apparently, they have fully as good control as the normals of these movements made with the eyes closed. There does not, then, seem to be any weakness in the kinaesthetic field, that is, as far as arm movements are concerned.

The results of the visual imagery tests given to twelve stutterers at the Hospital showed more correspondence with intelligence than with severity of stuttering. Of the two men who did much better than the others in his test, one was a college graduate and the other had attended a university. They were both very bad stutterers. One other stutterer had practically recovered; he succeeded in only one out of the seventeen points scored in this test. Those who appeared lowest in intelligence did poorly in this test. Now it can be said of this test too that it tests "attention" along with imagery. But it differs radically from the above-mentioned "block test;" the instructions were repeated, if necessary, so that it would not really be a test of "span," that is, ability to hold a large number of things in the first grasp.

In the complex reaction-time test the stutterers do not seem to differ uniformly from the normals either in speed or in number of errors (false reactions). As to variability of reaction-time, the results do not show any strong indication that stutterers differ from normals. This test accordingly fails to give any evidence for greater instability or irregularity of reactions in stutterers than in normals. But there are, no doubt, characteristics of instability in other types of situations not reached by this test. Ex-stutterers, again, differ markedly from all the other subjects. They are unusually regular, as shown by their low score in variability of reaction-time. Here, then, is a trait which seems quite definitely associated with recovery from this speech defect.

The inhibition test shows no tendency in the stutterers to differ uniformly from the normals in mere amount of inhibition. Among certain stutterers, however, there was observed to be some individual correspondence between lack of inhibition in this test and lack of inhibition in speech and other behavior. According to teachers at the Industrial School, some of the boys who showed much lack of inhibition in this test showed the same characteristic lack of inhibition in their behavior on the school grounds. One, e. g., was quick to retaliate when out playing with the other boys. He had a "don't care" attitude, though he was much improved; he freely told, in a good natured way, how stubborn he had been when formerly brought into court. Another boy who showed much lack of inhibition in this test was flighty and constantly getting into trouble; and stuttered only in rapid speech, not in reading. A boy who showed less lack of inhibition than the average in this test, differed also in the form of his stutter: he hesitated and showed signs of hidden struggle in getting each word out. A stutterer, of another group, who showed much lack of inhibition in this test was troubled mainly by a strong tendency in all his behavior to react out of proportion to the intensity of the stimulus. Many of those who showed least lack of inhibition in this test (i. e. had fewest forbidden responses) showed great inhibition in their speech movements.

Partially inhibited responses are seen (Tables II and III) to be more numerous in the normals than in the stutterers. This relative scarcity of partial inhibitions in the latter shows itself clearly in both groups where recorded, while the number of completed forbidden responses mentioned above varied in different groups of stutterers. This indicates that the stutterers in these groups differ as to whether they will start or not start a wrong response, but they tend to agree in their inability to check or modify the response after it has started. It seems that the stutterer's response tends to be of the all-or-none type; that the impulse does not get started at all as overt response or, if started, it cannot easily be stopped midway or modified. It must run its entire course. In this connection it must be remembered that in speech there is an immense number of impulses at play. If, then, there is decreased ability to check or modify impulses midway in their course of expression, it is reasonable to expect greater disturbance from conflicting impulses and to expect blocking in speech movements to arise in this way. It is accordingly quite logical to assume that the trait which appears in this test, in a reaction

which is entirely outside of the field of speech, is an important part of the stutter mechanism. It is probably a general characteristic of the behavior of the individual, and common to many other than vocal reactions. This accords with the known fact that spasms and blockings analogous to stuttering occur in other than oral expressions, e. g., in writing movements.

The conclusions which at present seem most evident from these results may be formulated briefly as follows:

1—No reliable evidence is found in the tapping test for any defect of coordination or motor control at the level of the rapid but coarse muscular movements of tapping.

2—Rapidity in the type of reaction involved in tapping appears to be associated with recovery from stuttering.

3—Regularity of tapping rate seems to be associated with improvement in stuttering.

4—In the hand coordination test stutterers, in most groups, tend to do relatively better when following the beating of a metronome than when they simply go as fast as they can, while the opposite appears in normals. These findings are in harmony with the well known effect of imposed rhythm on the stutterer's speech. Here it apparently plays an important rôle in reactions entirely outside of the vocal field.

5—The stage of improvement in stuttering seems essentially to involve a disturbance in the types of coordination required in the hand coordination test.

6—The stutterers have in the block test a distinctly poorer memory span for movements than normals. It seems logical to consider the defect or difficulty to be one of coordination of the kinaesthetic and other imaginal elements when they appear in large numbers simultaneously, which happens, e. g., in conscious speech movements.

7—No evidence is found in the two-dot test for any weakness in the kinaesthetic field, that is, that part which is involved in arm movements.

8—The results from the visual imagery tests (from 12 subjects) show more relation to intelligence than to severity of stuttering.

9—No reliable difference is found between stutterers and normals as to speed or as to number of false reactions in the complex reaction-time test.

10—Stutterers do not show any more instability or variability of reactions in the complex reaction-time test than do normals. At least in this type of situation, stutterers appear to be fully as stable in their reactions as normals are.

11—Ex-stutterers are unusually regular in speed in the com-

plex reaction-time test. This trait is evidently associated with recovery from stuttering.

12—Stutterers do not show in the inhibition test any tendency to differ uniformly from normals in mere amount of inhibition.

13—Stutterers have in the inhibition test fewer partially inhibited responses than normals. It seems very probable that a general lack of ability to inhibit an impulse after it has found partial expression is an essential factor in stuttering.

AN EXPERIMENT IN THE USE OF MUSIC IN AN ARCHITECTURAL DRAFTING ROOM

By Esther L. Gatewood

This study undertakes to investigate the use of music in a specific situation, namely in an architectural drafting room, when the men are at work. Is the use of music of any value or significance in such a situation?

Many old legends relate stories of the effects of music upon the feelings and actions of the listener. More recent literature, with some historical authority, reports similar instances. Recently, experimental studies have been undertaken to scientifically prove or disprove these beliefs. Practically all of the reports and most of the experimental work have dealt with the passive listener, from the standpoint of enjoyment, of musical pleasure.[1] The effect of music upon work produced or upon people at work has not been systematically studied, although occasional references to its possible effect have been made.

A few scattered unregulated observations have been made on the use of music in learning typewriting, and certain other mechanical processes. These have, however, never been done under laboratory conditions, where the situation is controlled. No objective measurements have been made, nor have there been organized introspective reports. The technique and the reliability of the results are open to question. Attempts to obtain definite details from those who are reported to have made such experiments have resulted in the receipt of letters proclaiming the "wonderful effects," "greatly stimulating effect," "the unbelievable aid," etc., but giving no quantitative data.

For several months, my office was located, by chance, near the large drafting room of the department of Architecture of the Carnegie Institute of Technology. The work of the

[1] Gehring, Albert. The Basis of Musical Pleasure. 1910, New York.
Gilman, B. J. Report of Experimental Test of Musical Expressiveness. *Am. Jour. Psych.*, 1891, 1892, vols. 4, 5.
Downey, June. A Musical Experiment. *Am. Jour. Psych.*, 1899, v. 9.
Weld, H. P. An Experimental Study of Musical Enjoyment. *Am. Jour. Psych.*, 1912, vol. 23.
Mohler, Louis. Music Moods, 1916. Columbia Graphophone Co., N. Y.

students in this department is so arranged that each is given a big problem every six weeks. Most of this time they spend studying out the various parts of their respective problems. All the details are carefully planned and tried out before actual work on the drawing is begun. About a week before the finished sheet is due, they start to work.

Toward the end of the period, the men work early and late. The last four or five days, the students are "on charette."[2] The last few nights of the charette period, they work until very late, two A. M. being the closing time of the longest evening allowed.

Several times, when students were "on charette" some of the men had asked me for the use of the phonograph and a few records. Two of the men usually picked out a group of selections, which they used. The exact content of these groups, I do not know, except that a large proportion of it was late popular music, much of it jazz.

There was no question as to the enthusiasm of the men over having music occasionally. I was told frequently by various ones how much they had enjoyed it and how much it had helped them. However, from such remarks and testimonials, it is both unwise and unsafe to draw conclusions. That is exactly the unreliable basis for much of the popular literature on the influence of music. The fact that a few liked it was no evidence that others did, nor was there any certainty that the selections which these men chose represented the type of music others would like. Nor could one conclude that the selections which were chosen were the best for this particular purpose. Their reports were suggestive, but not conclusive, and I undertook to study these questions:

(1) Is music of any help in this particular situation, namely, the actual work of completing plans and drawings in an architectural drafting room?

(2) Is music, on the contrary, an unfavorable distraction to the worker?

(3) What type of music is most preferred under such circumstances?

(4) If music is desirable, in what way does the worker feel that the music helps?

[2] The term, "on charette" is brought over from the French. When plans and charts were due, a little cart used to go about through the streets to gather them in. Draftsmen were often seen running along behind the cart putting on the finishing touches. The term is now used to indicate the period of intense work, when finishing architectural plans or drawings.

(5) If music were constantly available, in what time units would it be used to the best advantage?

The situation in the drafting room made an ideal one for experimentation. Arrangements were made for one of the assistants to have the instrument brought into the drafting room just as on the previous occasions when they had borrowed it. They kept the instrument going in the usual manner, except that the re-creations used were those which I had selected for the occasion. The experimenter was merely a visitor with some of the students and none of them knew until afterwards that the music was being played with a purpose on this occasion. Many of the men expressed surprise when they realized why the writer had been there. The music was therefore introduced in a manner which caused no disruption to the work, and none of the antagonism to experimentation, which is so often felt, was aroused. The conditions were carefully controlled and at the same time, were perfectly normal so far as the students were concerned.

The data sheet, like the accompanying form, was prepared. This was so planned that it was unnecessary for one to write lengthy answers to any of the questions; a check mark or figure sufficed. This was done for two reasons. First, it made the answers comparable. Too often results of such experiments are given in terms of the remarks of the observers, and there is no satisfactory means of converting the opinion of one into the same terms as the opinion of another. Second, it required as little time as possible from the men at work, and their serious coöperation was thus obtained, whereas, with a lengthy questionnaire which required much of their time, they would have been unwilling observers. These report sheets were passed out at the end of two hours. Only then did the men suspect that the music had been given to them for a purpose. They were much interested and serious in their reports.

An Edison " laboratory model " phonograph, the same which had been loaned to them on previous occasions was used. A set of re-creations (the Edison trade name for their phonographic records) was purposefully selected so that it included various types of music, of instrument and rendition. The entire group contained forty-five selections, several each of band, orchestra, chorus, instrumental solos and vocal solos, rhythmic waltzes, one vocal quartet and many jazz or popular dance numbers. Some of the jazz selections were not used, so that the number was somewhat reduced. The instrumental solos included violin, piano, flute and cello; the vocal solos,

each kind of voice, soprano, contralto, tenor and baritone. I had previously arranged the re-creations in such a way that there was a fairly even distribution of each type.

Name.....Date.....
Check the appropriate answers in the blank spaces indicated.
Does the presence of music make your work any easier?
Yes.....No.....
Does the music distract you from your work?
Yes.....No.....
Check the types of music which you liked best (not in general, but with your work tonight). Check one of each pair.
Instrumental.....Vocal.....
Loud.....Soft.....
Slow.....Fast.....
Non-jazz.....Jazz.....
Familiar.....Unfamiliar.....
Number in order the types you preferred most with your work.
Standard orchestral selections.....
Instrumental (violin, piano, etc.) solos.....
Vocal solos.....
Jazzy dance numbers.....
Rhythmic waltzes.....
Lively chorus numbers.....
How do you think music helps? Check.
Rhythm speeds actual work.....
Keeps you happy.....
As rest between work.....
Give any other reason.....
Assuming you could have music whenever you wanted it, how often would you have it? Check.
Rarely and for a short period.....
" " " " long " .....
Often and for a short period.....
" " " " long " .....
Most of the time.....
Not at all.....

Remarks———————————————————

Results.—Replies were received from fifty-six men, although not all answered every question. To the first question, "does music make work easier?" forty-nine (49) answered 'yes' and only five (5) 'no.' Six (6) men declared that music distracted them from their work, while forty-seven (47) answered that it did not. The seeming inconsistency of the one person who claimed that music distracted him and yet that it made work easier is not impossible. He was one of those who felt that music was a help if used as a rest at intervals between work periods.

In answer to the third question, on the various types of music most suitable, the preferences are expressed in the following table, which is arranged to show the contrasting types:

instrumental	37	vocal	3
loud	19	soft	19
slow	15	fast	12
non-jazz	15	jazz	22
familiar	30	unfamiliar	2

Not only do the figures show that instrumental selections are very much preferred to vocal numbers, but also the comments made whenever vocal selections were played, showed that they were irritating. According to a questionnaire sent out to a large number of phonograph owners, many more people express a liking for vocal music in general than for instrumental. In this sort of a circumstance, however, when the individuals are working, and the music is merely an incidental feature, instrumental music is greatly preferred. Either voice quality, or what is more likely, the presence of words, proved to be an irritation as well as a distraction. The effect is very like that which one experiences when he is trying to prepare a lesson or write a theme, and some one in the room talks to himself or to some one else. There is usually an effort to listen to at least a part of the words, and the attention of the worker shifts back and forth from the song to his work. This interruption is not evident with instrumental music.

Vocal music compels the attention, whether willing or unwilling, of the audience. It forces itself upon its hearers. This fact is evident in a drawing-room party. If some one renders a vocal solo, the audience usually gives attention whether the performance be good or bad. On the other hand, if some one gives a piano solo, oft-times in spite of the fact that it is unusually well done, the music is interpreted as a signal for conversation. Certainly, if the audience is given to conversation, the presence of instrumental music is not the distraction that vocal music is.

There was an almost equal division of opinion on the question of tempo and volume. Usually slow tempo and soft were preferred by the same individual and fast tempo and loud by the same individual. It is difficult to determine just how much of this is indicative of the individual's own personal preferences, and his preference for this particular kind of music when working. Special pains were taken however to have the comparison on the basis of the selections just heard, and

I do feel that the judgments rendered are reliable. One can readily understand why loud and fast, and soft and slow are linked up together. Loud slow music forces itself upon the listener, in accented puctuated measure that distracts, and also causes the movement to lag. Slow soft music, on the other hand, is very soothing and rarely annoys or even distracts the hearer.

More scored jazz than scored non-jazz, and several did not score either. Those who did not score either gave answers to some of the other questions which would make a scoring on jazz very unlikely, so that the division between the two is approximately equal.

Familiar music is greatly preferred to unfamiliar music. Several men explained that if the selection were a new one, they wanted to listen to the melody, and if it were a song, they listened to the words. In a selection that is already familiar, little or no attention is consciously given to the words, and the music is merely a pleasant accompaniment to the work, and in no way a distraction.

The selections used for the experiment included several of each of the following types: standard orchestral, instrumental solos, vocal solos, jazzy dance numbers, rhythmic waltzes, and some lively chorus numbers. In question four, the men were asked to indicate the order in which they preferred the several types. The relative order of the various types proved to be the following:

1. Jazzy dance
2. Standard orchestral
3. Rhythmic waltz
4. Instrumental solo
5. Lively chorus
6. Vocal solo

This rank order is based on the number of first, second and third rank votes given each type by the entire group of men. From whatever angle the data are studied, solo numbers are less desirable than ensemble, and vocal music less desirable than instrumental. It is evident that vocal music is not suitable for such a purpose as we are investigating. Those who gave the most careful consideration to the whole questionnaire, ranked instrumental solos and orchestral numbers higher than they did the two dance types. This however may be an indication of the more serious type of individual and his preference for music other than the dance.

One other argument, from an objective viewpoint, lends favor to the use of standard orchestral selections in preference

to the jazz type. The room is noticeably noisier when loud jazzy numbers are played and more talking goes on. Some of the energy of the worker goes out in a form that does not show in his drawings. When quieter, more standard selections are played, there is less confusion in the room and one worker does not disturb another. It is possible that some individuals may work better in short periods between jazz numbers, and so in the end accomplish as much as those who work continuously using a different type of music. This is not likely of the group as a whole, although a certain amount of the livelier sort of music is doubtless useful.

Determination of the causes of the beneficial results from using music during the charetting period is more difficult. A comparison of the introspective judgments of the entire group brought out some interesting facts. Only three explanations were suggested on the data sheet, no others having at any time been offered. Asking on the data sheet for other reasons, and questioning some of the men informally afterwards brought out no further explanations.

Twenty-two (22) of the men felt that the music actually speeded their work, that fast rhythmic selections quickened their movements. Some explained that they felt a tendency to keep the rhythm of the music as they drew, as for example, in shading. However, with most of them, the music seemed to be rather a nervous stimulation, which brought out increased activity in the work. This speeding the movements is in keeping with the preference on the part of many for the quick jazz music, and the livelier orchestral selections.

Forty-one (41) of the draftsmen asserted that music keeps them happier, and that they can do more work and better work when they are in good spirits. Twenty (20) of them explained that the music furnished a rest period between working periods. This function may not be unlike that of keeping the men happy, although the temporal use is different. To those who prefer it as rest, at intervals, there arises the difficulty of determining the proper intervals, and indeed this element is apt to vary with individuals to such an extent that with a large group it would be extremely difficult. However, what seems to be the explanation is that the listener is able to ignore the music and consider only his problem when he is working and really notice the music only when he pauses to rest or to think over the next step in his work.

Not a few of the men indicated more than one of the above replies. Many of them suggested that the music helped keep them in good spirits, and also that it served either as an actual

accelerator to their work, or as a rest. There is certainly no doubt in the minds of the men who have tried it that either by actually speeding the movements of the worker or by mentally stimulating him, music does increase the ease with which this work is done.

As a result of the last question, concerning the most satisfactory time distribution, the desirability of the music was further substantiated. Twenty-one (21) replied that if they could choose the time, they would have the music often and for short periods, nine (9) often and for long periods. Twenty-eight (28) answered that they would like it most of the time. Some few stated explicitly that they would like it most of the time, but in short periods, some others that their preference would vary with the circumstances. Only one (1) asserted that he would want it "not at all," none "rarely and for short periods." No exact definition was given of the length of a long period or a short period. A long period was taken to mean continuous playing for approximately half an hour, while a short period was taken to mean the playing of three or four records, followed by a period without music. Many of the men expressed the opinion that they would prefer it frequently and for short periods, while an equal number prefer it most of the time. There seems to be no doubt in the minds of these men at least that music is a highly desirable accompaniment to their work.

Conclusions

(1) The use of music, rendered by means of the phonograph, was felt by the workers in an architectural drafting room to be of decided advantage.

(2) Only a small percentage of the workers reported that they found the music a distraction or a hindrance to their work.

(3) Instrumental music is much preferred to vocal music for this purpose.

(4) Music unfamiliar to the listener is not as desirable as familiar music. It becomes more or less of a distraction.

(5) According to the reports of the workers, the aid of music is of two sorts. Many feel that it actually speeds movement, and practically all the workers find that it has a beneficial effect on the mood or spirits, which in turn is reflected in the work. It is not unlikely that it performs both of these functions.

(6) Music is not a feature to be used rarely as a sort of diversion or intermission, but instead may be used to advan-

tage along with the work, a large part of the time. To have music frequently and for short periods appears to be most desirable and beneficial.

So many unfounded statements have been made on the advantages or values of music in industrial situations, that the natural result has been a tendency to consider all such reports the mere opinion of some sentimental enthusiast. It is, therefore, of peculiar significance that the results of such an experiment, unbiased by any popular enthusiasm, should be positive, and that the workers themselves should be so definitely convinced of the desirability of the use of music. It is not safe to generalize from this particular performance to other industrial situations, but it is not unlikely that experiments in many other fields may show similar results. However, we can safely say that the introduction of certain kinds of music proves to be both desirable and beneficial in the drafting room.

THE RESULTS OF SOME TESTS ON FULL AND MIXED BLOOD INDIANS[1]

By THOMAS R. GARTH, University of Texas

The objective of Racial Psychology of an experimental character should be first to find norms and the measures of variabilities around these norms. These should stand as inventories of the races measured. But if we follow out the latter conception the complete distributions of the measures would be a truer representation of the facts. And having obtained these, our next intention would be to make comparisons between the races. Even though our method may be avowedly scientific, we may well take caution in the making of these comparisons because of the ever present bias due to race prejudice which may cause us to hasten to conclusions and thus endanger the socalled inferior races with the stigma of being rated low. For this reason there ought to be a canon in the study of *race* psychology similar to the famous Canon of Lloyd Morgan in his studies of animal behavior. While Morgan's basal principle reads: "In no case may we interpret an action as the outcome of the exercise of a higher psychical faculty" (of lower animals), "if it can be interpreted as the outcome of the exercise of one which stands lower in the psychological scale;" the canon for race psychology might read after this fashion (with due apologies to the British scientist): In no case may we interpret an action as the outcome of the exercise of an inferior psychical faculty, if it can be interpreted as the outcome of the exercise of one which stands higher in the psychological scale, but is hindered by lack of training.

There is still a third objective in the study of racial psychology of which little has been said and of which insufficient use has been consciously made. Mental measurement has taught us to seek out the subnormal child so that we may give him such opportunity as he may need to bring him to his full development. Measures of the inferior races have indicated some superior individuals in the racial group who even take a position beside those above the median of the superior race with which we are comparing them. The third objective then of racial psychology should be to discover these superior individuals who find themselves contending with unfavorable environmental and traditional conditions. It

[1] Paper read before American Psychological Association, Chicago, December 30, 1920.

is not in the province of racial psychology to indicate what should be done for these "superiors," but only to find these individuals.

While the problem involved in the experiment which is to be described and interpreted is to find out how Mixed and Full Blood Indians differ in the results of their performances of nine psychological tests, it has all the objectives mentioned above embodied in it, though it arrives at them in a preliminary fashion.

The subjects included three hundred and eighty-four Indians of the United States Indian School at Chilocco, Oklahoma, of whom 198 were males, 77 being mixed blood and 121 full blood Indians, and 186 females, 78 being mixed and 108 full bloods. Nearly all of them were Plains and Forest Indians. Their ages ranged from 9 to 26 years and their educational attainment ranged from the fourth to the tenth grade. To these Indian students were given four association tests: Opposites, genus-species, part-whole, and free (continuous) association; three memory tests: concrete and abstract rote memory and logical memory; and two word-building tests: *apirle* and *aeobmt*.

These tests were given in the spring of 1920. The technique was the same as that used by Pyle and his associates in giving all of these tests to Whites and Negroes, and some of them to Chinese. (School and Society, Vol. I, p. 357 and Vol. II, p. 264.) Other tests were given but the results are not presented in this paper.

While it will be observed from the above description that we have here groups of different ages, education, and sex, as well as different blood, the subjects were classified with reference only to sex, racial blood, and age. A further breaking up of the original group of subjects into educational grade groups would make the sub-groups too small, so that this classification has been deferred until larger numbers of Indian children can be secured for testing with the same material.

The first draft of the data is presented in the accompanying tables, the data for the males being given in Table I and that for the females in Table II. In both tables, as we have said, the data for Mixed Bloods and Full Bloods are kept separate and these large groups are again subdivided into age groups running from 9 years to adult age, which means here from 19 to 26 years. The number of cases for each age group is designated also. In the Mixed Blood groups for both sexes the average degree of Indian Blood for an age group is indicated, and for all age groups we have the average school grade attainment. The subjects were just

finishing the designated school grades, for the tests were given in March or toward the close of the school year. The tables give the averages, the A. D., P. E., and range for all age group divisions for every measurement undertaken. In addition is shown the overlapping in each age group from the 14th year up, which indicates the per cent of Mixed Bloods attaining and exceeding the median score of the Full Bloods.

The norms for Mixed and Full Blood Indians shown here are of necessity only tentative because of the size of the groups. It is likely that radical changes will occur in them when more racial material of a similar kind can be obtained. However, within the limits of the data at hand, we may say what follows. In our search for differences which these data show between Mixed and Full Bloods of the Indian race, we shall consider these facts:

I. The average of each age group for Mixed Bloods and Full Bloods;

II. The instances where 60% or more of the Mixed Bloods attained the median of the Full Blood scores in each age group; and

III. A comparison of range of the Mixed Bloods and of the Full Bloods.

IV. However, inferences drawn from these findings must be modified by the differences in educational attainment and social status between the Mixed and Full Bloods.

If we take for purposes of comparison the average performance of each group of mixed and full blood individuals for each test we find that the Mixed Bloods excel the Full Bloods in most of the cases. In the case of the comparison of the results for the males, the Full Blood fifteen year and adult groups excel in free association; their fourteen and eighteen year groups excel in concrete memory; their seventeen year group in abstract memory; their fifteen, eighteen year and adult groups in both word-building tests; and their seventeen year group in the second word-building test. That is, there are twelve instances in which the average of these full blood Indians excel out of fifty-four possible instances, or 22% of the time. The case of the females is not even so good as this, for there are only four instances in which the Full Bloods excel the Mixed Bloods, *i. e.*, the adult group in genus-species, the fourteen year and adult group in concrete memory, and the adult group in abstract memory. This makes four out of a possible fifty-four, or 7% of the instances. Then the evidence from comparison of the averages favors the Mixed Bloods.

A fairer test would be to find the overlapping, as for instance, to what extent the Mixed Bloods excel or attain the median of the Full Bloods. We find that for each test 60% and better of the Mixed Bloods attain and exceed the median of the Full Bloods for each age group in all tests except in the following instances: males, fifteen year olds in opposites, eighteen year olds and adults in genus-species, eighteen year olds in concrete memory, seventeen year olds in abstract memory, fifteen year olds and adults in logical memory, fifteen year olds and adults in part-whole, likewise, and fifteen, eighteen year olds and adults in both word-building tests; females, adult group in genus-species, fourteen year olds in free association, and adults in abstract memory, seventeen year olds and adults in part-whole association and also in the first word-building test, and sixteen year olds in the second word-building test. To sum this up the Mixed Bloods have this 60% and better of their respective groups attaining and exceeding the median of the Full Blood in 39 out of a possible 54, or 72% of the time for the males, and 46 out of 54 times, or 84.4% of the time for the females. This likewise favors the Mixed Bloods.

Attention should be called to the fact that in making the above comparisons certain age groups of the Full Bloods stand out prominently in several of the tests, particularly the fifteen year, eighteen year, and adult groups of males, and the adult females. There are evidently more superior individuals in these age groups than in the other age groups of the Full Bloods. This naturally brings us to a consideration of the range in the various age groups for purposes of comparison. Upon making such an investigation we find for the males that the upper range of the Mixed Bloods is greater than that of the Full Bloods 51.8% of the time, using the age groups here as bases for comparison as before, or 28 out of 54 times. For the rest of the time the latter excelled the former in going beyond their upper range, except twice, when their upper ranges were equal. In other words, for every excellent performance of any Mixed Blood individual, nearly half the time there was a full-blood Indian to match his performance or to excel it. It is not so for the females of this blood group, for when their upper range is compared with that of the other blood group of their sex it is seen that 40 times out of 54 the Mixed Blood upper range is greater than that of the Full Bloods i. e., 74% of the time. In only nine instances was the upper range of the latter female group greater than that of the former and in five instances it was equal to it.

As to the Full Blood lower range, it was below that of the Mixed Bloods 34 out of 54 times —62.9% of the time for the males, and it was about the same, 35 times out of 54 —64.8% for the females, and as good or better for both sexes during the rest of the time. The presence of the superior performers among Full Bloods in the 14, 18 year, and adult groups for the males is again made evident by this examination of the range, and it is somewhat so for the female adults.

Before undertaking to draw conclusions from the above comparisons, two additional factors should be considered, *i. e.*, social status and education. The data at hand offer little information with reference to social status. We can say that the males, from the fourteenth year up, were on the average 54% Indian blood, and the females slightly more, but both are practically the same, and while we know little of the social status it is safe to draw the inference that since they were nearly half white, all of them being mixtures of whites and Indians, the influence of the white parent would necessarily improve the social status from the white standpoint and this would be above that of the individual of full blood parentage more or less biased by primitive traditions. And as to education, the average attainment for the Mixed Blood males is 7.4 grades, ranging from 5th to 10th grade and for the females was 7.3 grades, ranging from 4th to 10th; whereas for the Full Blood males the average school attainment is 6.2 grades ranging from 4th to 10th grades, and for the females 5.8 grades, ranging from 4th to 9th.

The relative lack of social pressure to go to school is evident in the Full Blood group which, to be sure, is the result of primitive apathy or lack of enthusiasm for the white man's education. Nevertheless, this should not be regarded as peculiarly an Indian trait, though it assuredly militates here against better performance in the psychological tests for the Full Blood Indian.

From the above experiment then we conclude that in a comparison of Mixed and Full Blood Indians as to their ability in the performance of certain tests, the Mixed Bloods tend to excel the Full Bloods on a score of averages, measure of per cent of the former to attain the median of the latter and as to upper range of scores, but many Full Blood individuals attain and excel the performance of Mixed Blood individuals. Furthermore the scores of the Mixed Bloods is favored by their superior social status and educational opportunity. However, the writer doubts if an equality of school attainment would remove the indicated differences, not as measured, but in their trend.

FROM THE PSYCHOLOGICAL LABORATORY OF THE UNIVERSITY OF TEXAS

THE RESULTS OF SOME TESTS ON FULL AND MIXED BLOOD INDIANS

The problem is to find out how Mixed and Full Blood Indians differ in the results of their performance on nine psychological tests.

TABLE I

Males: Age—Years	9	10	11	12	13	14	15	16	17	18	Adult
Mixed Bloods:											
No. Cases	1	0	3	2	5	7	11	13	9	12	14
*Av. De. I. B	75	..	.50	.38	.75	.52	.61	.57	.47	.59	47
Av. Years Ed	4	0	47	4.0	5.2	5.1	6.0	7.7	6.6	7.9	7.8
A. D	..	..	...	....	....	1.5	.7	1.1	.8	1.3	.9
P. E	..	..	...	....	....	1.2	.5	.9	.6	1.0	.7
Range	4	..	4–5	4–4	5–6	5–6	5–8	5–10	5–9	5–9	5–10
Full Bloods:											
No. Cases	..	..	...	4	5	10	10	24	17	22	29
Ave. Years Ed	..	..	...	5.0	4.6	4.8	5.4	5.6	5.9	6.5	7.6
A. D	..	..	...	....	....	1.0	1.1	1.7	1.3	.9	1.9
P. E	..	..	...	....	....	.8	.9	1.4	1.0	.7	1.4
Range	..	..	...	4–7	4–5	4–6	4–8	4–8	4–9	5–9	4–10
Opposites' Test:											
†M. B. Ave. Score	10	..	7.3	7.5	11.2	9.6	9.2	12.0	12.9	11.0	11.4
A. D	..	..	.8	.5	2.3	2.7	3.6	4.6	2.8	3.8	3.4
P. E	..	..	...	....	....	2.1	2.9	3.6	2.2	3.0	2.7
Range	..	..	6–8	7–8	9–17	4–15	0–16	1–20	7–19	2–18	5–15
F. B. Av. Score	..	..	...	8.0	8.8	8.7	9.0	9.3	6.9	8.7	9.3
A. D	..	..	...	3.5	1.5	1.8	2.6	3.2	3.0	2.3	3.7
P. E	..	..	...	....	....	1.4	2.1	2.5	2.3	1.8	2.9
Range	..	..	...	3–15	5–11	2–17	4–14	3–15	3–12	3–17	1–19
††%M. B. at Med. of F. B	..	..	...	....	....	62.5	55.5	69.2	100	72.8	76.9

*Average degree of Indian Blood.
†M. B. indicates Mixed Bloods.
F. B. indicates Full Bloods.
††Per Cent of Mixed Bloods attaining medium of Full Bloods.

Genus-Species' Test											
M. B. Av. Score.....	12	..	6	.6	7.6	8.4	9.9	11.7	10.4	10.1	10.0
A. D.....	..	..	.5	2.2	2.1	1.8	3.7	3.2	3.5	3.3	3.3
P. E.....	..	..	....	....	....	1.4	2.9	2.5	2.8	2.8	2.7
Range.....	..	..	4–8	2–10	3–10	5–10	3–16	4–20	4–19	4–17	5–19
F. B. Av. Score.....	..	..	...	6.8	6.2	7.4	7.4	7.7	9.9	9.0	9.5
A. D.....	..	..	...	2.2	2.2	4.0	2.2	3.2	2.7	2.9	4.0
P. E.....	..	..	...	....	3.1	1.8	2.5	2.1	2.3	2.3	3.2
Range.....	..	..	...	5–11	3–9	1–19	4–13	1–15	4–13	2–16	3–16
Per Cent. of M. B.'s Att. Med. of F. B.'s..	..	..	...	....	....	85.7	63.6	83.7	62.5	50	57.1
Part-Whole Test:											
M. B. Av. Score.....	12	..	7.5	6.0	7.8	9.2	10.8	11.8	10.9	11.9	10.2
A. D.....	..	..	?	?	?	2.2	4.5	3.0	2.3	5.2	5.2
P. E.....	..	..	....	....	....	1.7	3.8	2.5	1.9	4.1	4.3
Range.....	..	..	5–9	6	5–11	4–13	0–19	5–18	5–17	3–19	1–20
F. B. Av. Score.....	..	..	...	7.7	7.0	8.2	9.6	8.9	9.0	9.0	9.4
A. D.....	..	..	...	?	?	2.2	2.1	4.5	3.6	3.6	4.4
P. E.....	..	..	...	....	....	1.9	1.7	3.7	2.9	2.7	3.4
Range.....	..	..	...	1–19	3–9	4–12	0–13	0–20	0–14	0–20	1–19
Per Cent. M. B.'s Att. Med. of F. B.'s.....	..	..	...	....	....	80	55.6	75.0	60	60	57
Free Association Test:											
M. B. Av. Score.....	37	..	49.3	56	50	46.7	44.8	50.3	46	50.4	44.3
A. D.....	..	..	...	7	6.4	7.7	9.9	10.9	5.2	8.8	9.6
P. E.....	..	..	....	....	....	6.2	8.1	8.7	4.1	7.1	7.7
Range.....	..	..	42–55	49–63	42–60	32–58	8–72	29–66	23–59	33–70	16–78

FROM THE PSYCHOLOGICAL LABORATORY OF THE UNIVERSITY OF TEXAS—Con.

THE RESULTS OF SOME TESTS ON FULL AND MIXED BLOOD INDIANS

Males:											
Age, Years	9	10	11	12	13	14	15	16	17	18	Adult
F. B. Av. Score	..	..	...	49.8	51.6	42.0	45.9	42.5	39.3	44.4	44.3
A. D	..	..	...	8.8	5.3	9.4	12.5	10.5	10.9	8.0	11.5
P. E	..	..	...	....	....	7.6	9.8	8.5	8.7	6.1	8.9
Range	..	..	...	35–67	42–58	28–58	27–72	11–67	14–70	5–75	10–84
Per Cent. M. B.'s Att. Med. of F. B.'s	..	..	...	....	....	71	54.4	62	78	75	54.5
Rote Memory Test—Concrete:											
M. B. Av. Score	44	..	38.2	35.5	39.8	41.4	42.6	41.2	40.5	40.5	43.9
A. D	..	..	...	....	....	3.5	5.8	5.6	5.6	3.5	4.2
P. E	..	..	...	....	....	2.8	4.7	4.2	4.5	2.7	3.5
Range	..	..	33–45	33–38	33–44	36–51	27–55	30–52	31–46	34–47	33–59
F. B. Av. Score	..	..	...	35	33.8	37.4	41.8	39.9	38.8	40.8	39.3
A. D	..	..	...	....	....	2.8	2.7	3.6	7.2	4.5	1.4
P. E	..	..	...	....	....	2.2	2.4	2.8	5.8	3.5	1.2
Range	..	..	...	23–42	24–39	33–42	36–47	31–49	26–49	28–56	32–53
Per Cent. of M. B.'s Att. Med. of F. B.'s	..	..	...	....	....	62	70	67	88	54	92
Rote Memory Test—Abstract											
M. B. Av. Score	36	..	34.5	26.0	33.0	32.8	33.4	37.7	30.9	38.8	37.2
A. D	..	..	...	....	....	4.9	3.2	7.6	5.1	3.9	5.4
P. E	..	..	...	....	....	3.8	2.7	6.3	3.8	3.1	4.3
Range	..	..	31–37	24–28	24–49	15–39	21–43	19–49	22–42	24–46	26–48
F. B. Av. Score	..	..	...	29.5	27.6	26.1	33.1	30.4	31.1	33.8	33.6
A. D	..	..	...	....	....	7.1	5.5	4.9	7.9	7.4	5.2
P. E	..	..	...	....	....	6.1	4.7	3.8	6.3	6.2	4.3
Range	..	..	...	22–37	25–29	17–43	19–45	18–44	6–43	17–52	21–44
Per Cent. of M. B.'s Att. Med. of F. B.'s	..	..	...	....	....	87	70	75	50	85	69

Logical Memory Test:										
M. B. Av. Score.....	36	..	21.3	35.0	25.0	28.9	21.5	30.3	34.9	24.5	26.2
A. D.....	..	..	5.8	7.0	10.4	7.2	11.6	8.6	10.1	4.6	8.7
P. E.....	..	..	...	....	....	5.8	9.4	6.8	9.9	3.6	6.9
Range.....	..	..	9–25	28–42	15–43	9–39	0–47	11–43	0–50	9–31	12–43
M. B. Av. Score.....	..	..	...	24.6	14.5	20.4	19.9	21.9	21.2	22.0	22.6
A. D.....	..	..	...	7.9	8.0	13.1	14.3	12.2	10.1	10.7	10.0
P. E.....	..	..	...	....	....	10.3	11.4	9.8	7.7	8.6	8.2
Range.....	..	..	...	15–35	0–22	0–35	8–34	4–37	0–44	0–51	0–45
Per Cent. of M. B.'s Att. Med. of F. B.'s .	..	..	...	....	....	86.0	58.0	82.0	75.0	80.0	53.0
Word Building AEIRLP Test:										
M. B. Av. Score.....	9	..	17	11.0	14.8	14.1	13.0	13.4	13.9	11.5	11.3
A. D.....	..	..	...	....	....	4.1	4.0	4.4	3.9	4.5	4.5
P E.....	..	..	...	....	....	3.3	3.4	3.5	3.1	3.5	3.4
Range.....	..	..	16–20	10–12	9–17	6–20	4–20	3–20	9–21	0–18	0–21
F. B. Av. Score.....	..	..	...	14.8	11.4	12.4	13.5	11.9	11.3	12.1	12.5
A. D.....	..	..	...	....	....	4.9	3.0	3.3	3.1	3.2	4.9
P. E.....	..	..	...	....	....	3.8	2.4	2.6	2.4	2.5	3.9
Range.....	..	..	...	11–18	5–18	3–22	9–18	2–18	5–18	4–21	0–22
Per Cent. of M. B.'s Att. Med. of F. B.'s..	..	..	...	....	....	75	37	66.7	66.7	45.5	55.5
Word Building AEOBMT Test:										
M. B. Av. Score.....	15	..	13.3	11.0	15.0	13.2	13.0	14.4	12.0	11.6	12.2
A. D.....	..	..	...	....	....	2.7	3.2	3.8	2.4	5.1	4.1
P. E.....	..	..	...	....	....	2.2	2.5	3.1	2.1	4.1	3.3
Range.....	..	..	10–16	11–11	10–21	8–18	5–19	8–19	8–17	1–18	2–20
F. B. Av. Score.....	..	..	...	12.5	9.0	11.3	13.6	12.5	12.3	13.8	13.8
A. D.....	..	..	...	....	....	3.4	3.6	3.8	3.4	2.0	3.7
P. E.....	..	..	...	....	....	2.8	2.7	3.2	2.6	1.7	2.9
Range.....	..	..	...	5–20	5–8	5–17	7–19	3–20	5–19	7–18	5–23
Per Cent. of M. B.'s Att. Med. of F. B.'s..	..	..	...	....	....	50	45.5	72.7	60	50	62

FROM THE PSYCHOLOGICAL LABORATORY OF THE UNIVERSITY OF TEXAS—Con.

THE RESULTS OF SOME TESTS ON FULL AND MIXED BLOOD INDIANS

TABLE II

Females:											
Age Years	9	10	11	12	13	14	15	16	17	18	Adult
Mixed Bloods:											
No. Cases	0	0	2	1	3	15	9	17	15	11	7
Ave. De. I. B.	..	..	.50	.50	.62	.56	.50	.57	.57	.57	.53
Ave. Yrs. Ed.	..	..	4.0	6.0	6.0	5.9	7.0	7.1	7.9	8.3	8.9
A. D.	..	..	...	....	....	1.1	1.8	1.2	1.5	1.7	1.4
P. E.	..	..	...	....	....	.9	1.4	.9	1.2	1.4	1.1
Range	..	..	4–4	6	5–7	4–8	4–10	4–9	5–10	6–10	4–10
Full Bloods:											
No. Cases	..	1	1	3	5	18	15	15	27	16	7
Av. Years Ed.	..	4.0	5.0	4.0	5.6	5.2	5.3	5.4	6.4	5.2	7.5
A. D.	..	..	...	....	....	1.0	.8	1.5	1.0	1.3	1.5
P. E.	..	..	...	....	....	.8	.6	1.2	.8	1.0	1.3
Range	..	..	5	4–4	5–6	4–7	4–7	4–9	4–9	4–9	6–9
Opposites' Test:											
M. B. Ave. Score	..	..	15	20	13	11.1	14.2	13.4	14.4	15.2	13.5
A. D.	..	..	...	....	....	2.2	3.5	3.7	4.6	2.4	3.2
P. E.	..	..	...	....	....	1.7	2.8	2.7	3.8	1.9	2.7
Range	..	..	13–17	20	11–16	2–19	0–19	2–20	2–20	11–19	8–19
F. B. Av. Score	..	..	6	10	10.4	7.9	9.7	8.7	10.7	7.4	10.9
A. D.	..	..	...	....	....	3.0	3.2	3.8	3.6	3.9	6.2
P. E.	..	..	...	....	....	2.7	2.6	3.0	2.9	3.1	5.1
Range	..	..	6	9–11	5–14	1–14	4–17	0–16	0–17	0–18	1–18
Mixed Blood Att. Med. of F. B.	..	..	...	....	....	68.8	100	88.2	71.4	100	75

Genus Species' Test:									
M. B. Av. Score	16.5	16.0	12.8	11.0	12.4	13.2	13.2	14.0	12.4
A. D	...	....	3.4	4.4	2.7	4.7	4.1	4.2	3.2
P. E	...	....	....	3.5	2.2	3.6	3.4	3.6	2.7
Range	9–15	12	9–16	4–20	6–17	2–20	3–19	8–20	4–19
F. B. Av. Score	6.0	8.5	10.6	8.0	9.8	7.8	10.8	8.3	13.6
A. D	...	....	2.3	2.4	3.3	3.5	4.0	3.1	5.6
P. E	...	....	....	1.9	2.6	2.8	3.4	2.4	4.7
Range	6	4–13	8–14	0–15	2–16	1–15	3–20	2–20	11–20
Per Cent. of M. B.'s Att. Med. of F. B.'s	...	....	....	73.8	80	88.2	66.7	100	29
Part Whole Test:									
M. B. Av. Score	10.5	12.0	9.0	7.8	9.2	9.4	9.5	10.7	9.8
A. D	...	....	....	4.1	4.4	2.1	3.1	3.4	3.6
P. E	...	....	....	3.4	3.5	1.6	2.4	2.7	3.0
Range	8–13	9–15	7–12	1–16	3–17	3–16	0–16	4–17	5–14
F. B. Av. Score	6.0	7.3	6.4	6.3	6.5	6.1	7.9	4.2	7.0
A. D	...	....	....	2.5	2.8	3.7	3.2	3.4	3.8
P. E	...	....	....	2.0	2.1	3.1	2.6	2.8	3.1
Range	6	3–10	1–10	1–11	3–15	0–12	1–14	0–12	2–12
Per Cent. of M. B.'s Att. Med. of F. B.'s	...	....	....	62.5	67	88.2	54	90	50
Free Association Test:									
M. B. Av. Score	38	55	43	45.8	48.9	53	52.7	55.5	56.6
A. D	...	....	7.3	7.8	11.9	10.1	10.6	9.9	12.8
P. E	...	....	....	6.1	8.5	8.0	8.3	7.4	10.2
Range	36–36	32–53	26–67	16–67	16–67	16–66	17–70	43–68	31–71

FROM THE PSYCHOLOGICAL LABORATORY OF THE UNIVERSITY OF TEXAS—Con.

THE RESULTS OF SOME TESTS ON FULL AND MIXED BLOOD INDIANS

Females:											
Age, Years	9	10	11	12	13	14	15	16	17	18	Adult
F. B. Av. Score	..	..	48	54	36.8	43	46.9	43.2	42.5	39.2	54.5
A. D	..	..	...	....	7.0	9.2	9.6	9.9	4.9	10.4	7.3
P. E	..	..	...	....	....	7.1	7.5	7.8	3.8	8.5	5.8
Range	..	0	48	45–62	22–46	23–58	11–67	16–68	25–65	17–62	44–71
Per Cent. of M. B.'s Att. Med. of F. B.'s	..	..	...	....	....	46.7	67	93.8	73.3	91	71.4
Rote Memory Test—Concrete:											
M. B. Av. Score	..	..	39	44	45	37.5	44.8	42.3	41.4	45.1	46.3
A. D	..	..	...	0	7.0	6.4	3.4	4.4	5.3	4.3	3.6
P. E	..	..	...	....	....	5.2	2.8	3.9	4.2	3.5	2.7
Range	..	..	29–49	44	31–54	20–50	37–48	27–49	28–52	38–52	40–50
F. B. Av. Score	..	42	38	39	40.8	40.4	39.7	37.7	38.7	36.9	46.5
A. D	..	..	...	2	4.2	5.7	3.9	6.4	5.1	5.8	5.2
P. E	..	..	...	....	....	4.6	3.1	5.2	4.1	4.6	4.2
Range	..	42	38	37–41	37–50	28–58	33–47	31–58	22–48	26–51	40–51
Per Cent. of M. B.'s Att. Med. of F. B.'s	..	..	...	....	78	60	88	93	73	82	71
Rote Memory Test—Abstract:											
M. B. Av. Score	..	..	33	29	39.5	34.8	41	38.6	38.3	40.3	40.5
A. D	..	..	...	....	2.8	7.0	4.4	3.1	5.2	6.1	6.3
P. E	..	..	...	....	....	5.6	3.5	2.5	4.2	4.9	4.9
Range	..	..	28–38	29	32–46	19–49	32–46	31–47	26–47	30–52	25–54
F. B. Av. Score	..	32	18	31.5	36.4	28.9	33.5	30.9	32.3	28.9	41.9
A. D	..	..	...	....	7.3	6.3	4.7	6.9	7.5	7.5	5.2
P. E	..	..	...	....	....	5.1	3.8	5.9	6.0	6.2	4.3
Range	..	..	18	23–40	26–46	15–43	25–51	11–45	10–47	9–47	37–50
Per Cent. of M. B.'s Att. Med. of F. B.'s	..	..	...	....	....	66	100	93	67	100	29

Logical Memory Test:										
M. B. Av. Score	24	55	35.5	30.5	34.4	29.6	30.9	30.3	33.3
A. D	...	....	....	11.6	4.7	7.2	5.4	8.0	13.2
P. E	...	....	....	9.2	3.8	5.8	4.6	6.3	10.6
Range	21–50	55	26–44	19–47	18–42	12–46	24–44	21–41	13–49
F. B. Av. Score	11	31.5	26.3	24.0	24.2	21.9	23.9	16.9	27
A. D	...	....	....	9.5	5.4	9.0	8.7	9.1	10.3
P. E	...	....	....	7.6	4.2	7.2	6.8	7.3	7.7
Range	11	23–40	15–36	6–46	9–34	2–39	3–41	3–34	9–40
Per Cent. of M. B.'s Att. Med. of F. B.'s	...	....	....	72	90	81	79	93	67
Word-Building AEIRLP Test:									
M. B. Av. Score	7	11	12.5	11.7	15.8	15.2	13.7	16.4	13.9
A. D	...	....	....	3.9	3.4	4.6	4.3	3.3	4.5
P. E	...	....	....	3.2	2.8	3.7	3.5	2.7	3.8
Range	3–11	11	1–20	3–20	9–22	8–22	1–21	8–20	6–19
F. B. Av. Score	12	14.5	13.2	10.0	12.6	12.4	8.8	10.1	13.4
A. D	...	....	....	3.5	4.6	5.0	2.5	5.3	2.6
P. E	...	....	....	2.8	3.7	4.1	2.2	4.8	2.1
Range	12	10–19	10–16	1–20	2–20	1–20	0–22	0–18	7–16
Per Cent. of M. B.'s Att. Med. of F. B.'s	...	....	....	60	66.7	75	46.1	83.3	42.9
Word-Building AEOBMT Test:									
M. B. Av. Score	11.0	15.0	12–5	11.6	14.4	14.2	13.8	17.0	13.0
A. D	...	....	....	3.9	4.0	3.2	5.0	3.0	3.2
P. E	...	....	....	3.2	3.3	2.7	4.3	2.5	2.4
Range	11–11	15	3–19	2–18	4–20	4–20	1.21	3.22	2.16
F. B. Av. Score	1.0	1.0	15.5	12.8	11.4	11.8	13.1	12.4	12.7	12.7
A. D	...	....	....	3.4	3.7	2.6	3.2	4.4	4.5
P. E	...	....	....	2.8	3.2	2.1	2.6	3.5	3.4
Range	11	15–16	10–16	4–17	0–18	2–14	1–19	5–21	2–20
Per Cent. of M. B.'s Att. Med. of F. B.'s	...	....	....	46.7	70	56.2	66.7	90	85.7

TABLE III

In this table the data of Tables I and II are combined into totals for both sexes and all ages, but the division of Mixed and Full Blood remains.

	Age		Educational Attainment		Opposites Test-Score	
	M.B.*	F.B.*	M.B.	F.B.	M.B.	F.B.
No. Cases	158	226	158	226	157	214
Average	16.4 yr.	16.1 yr.	6.9 yr.	5.9 yr.	12.2	8.4
A. D.	1.1	2.4	1.6	1.1	3.4	2.7
P. E.	.9	2.0	1.3	.9	2.9	2.3
Median	15.7	16.1	6.4	5.3	12.2	8.5
Range	9–23	10–26	4–10	4–10	0–20	0–19
% Reaching Med. of F. B.	43%		67%		78%	

	Genus Species Test-Score		Part-Whole Test-Score		Free Ass'n. Test-Score		Logical Memory Test-Score	
	M.B.	F.B.	M.B.	F.B.	M.B.	F.B.	M.B.	F.B.
No. Cases	166	223	162	209	151	227	164	214
Average	10.7	8.9	10.0	7.3	48.5	43.9	29.3	21.9
A. D.	3.5	3.4	3.8	3.8	5.0	10.7	9.2	9.6
P. E.	2.9	2.9	3.2	3.2	4.2	8.5	7.8	8.2
Median	10.5	8.1	9.5	6.9	49.6	44.5	29.9	22.1
Range	2–20	0–20	0–20	0–20	8–78	1–74	0–50	0–51
% Reaching Med. of F.B.	67%		78%		64%		68%	

	Rote Memory Concrete-Test Score		Rote Memory Abstract-Test Score		Word-Building Test-aeirlp Score		Word-Building Test-aeobmt Score	
	M.B.	F.B.	M.B.	F.B.	M.B.	F.B.	M.B.	F.B
No. Cases	155	224	155	224	153	223	157	224
Average	39.9	39.4	36.6	31.8	13.5	11.6	13.1	12.6
A. D.	2.7	5.7	5.4	2.9	4.2	3.7	3.9	.9
P. E.	2.3	4.8	4.6	2.5	3.6	3.1	3.3	.8
Median	42.1	38.5	35.5	31.5	13.2	12.3	13.4	13.5
Range	20–59	22–58	15–54	6-52	0–22	0–22	1–22	0–23
% Reaching Med. of F.B.	79%		75%		63%		54%	

*M.B. Mixed Bloods. F.B., Full Bloods.

A TEST FOR USE IN THE SELECTION OF STENOGRAPHERS

By M. A. Bills, Carnegie Institute of Technology

The results of using a battery of tests for the selection of stenographers were described in the September issue of the Journal of Applied Psychology. Further data regarding these tests have recently been collected, particularly with respect to the elimination from training courses, of those persons who are certain to fail.

In the previous investigation, the criterion of success consisted of the recommendations of the teachers in English, Typewriting and Stenography, made in January after five months' observation of girls being trained as stenographers. The tests which were found useful in eliminating failures were Bureau Test VI (an 'intelligence' test) and Bureau Test IX (a test of will traits). On the basis of the January ratings as a criterion, a score of 50 in Test VI and a score of 60 in Test IX, Part 10, were assumed as "critical" scores for success in the course. This standard in Test VI would have eliminated eleven failures and one success.

The passing of five more months led to some revision of recommendations by the instructors, and the test scores are, in the present study, regarded in the light of the changes in the criterion. The accompanying figure (Chart I) shows the relation of test scores to the January and the June ratings. Along the ordinate are represented scores in Test VI, and along the abscissa are shown the judgments of success or failure. As the previous article stated, a person who was recommended for continued work in typewriting or stenography, or for advanced courses, was considered a 'success.' Those who were recommended for service in manufacturing or clerical work were considered 'failures.' Each circle on the chart represents a person.

It is apparent that the later and more reliable criterion has justified a readjustment of the critical score for Test VI. The individual scoring 40, who was considered a success in January, has failed to "make good." Of the eight persons scoring between 50 and 60, two were regarded as failures in January and also in June, four were shifted from success in January to failure in June, one considered successful in January had

left before the end of the training course, and only one regarded as successful at the earlier time was still classified as successful.

These data justify the raising of the critical score in Test VI, for success in stenography, ten points—that is, from 50 to 60. In this way, eighteen failures and only one success are eliminated by Test VI alone.[1] In tabular form, omitting the cases of individuals leaving the course before completion, these results are as follows:

Failed in test and failed in course	18
Succeeded in test and failed in course	9
Failed in test and succeeded in course	1
Succeeded in test and succeeded in course	39
Total	67
Per cent correct	85

In order to test these results further, three different groups of professional stenographers have recently been given Test VI. The first group consisted of twenty stenographers employed by a single firm. Before the test was given to this group, the stenographers were rated on their value to the firm, by an executive who was in close contact with all of them. Of these twenty stenographers, only one made a score below the critical score set for the students of stenography, i. e., 60, and she was rated lowest by the firm. Table I shows the test scores of the group and their ratings by the executive. The rank correlation is +.75. When it is considered that length of service must have played some part in the rating, this correlation must be regarded as remarkably high.

A second group, consisting of seventeen stenographers and eight secretaries employed by a different firm (in an entirely different line of business) were given the same test. They were rated by an executive who knew them all, but did not wish to rank them. He divided them into three groups: those who were "failing," those who were "getting by" and those who were "good." Three of the seventeen were classed as "failures," 4 as "getting by" and 8 as "good." Two had been with the company too short a time to be rated. All of the secretaries were classed as "good." Table 2 gives the ratings, scores and positions of these stenographers.

The mean score for secretaries is 144, for stenographers rated "good," 110; for stenographers rated as "getting by," 65; and for those "failing," 63. Only two made a score less

[1] The standard of 60 in Test IX, Part 10, would have eliminated three who failed in January and none who succeeded. These three persons (indicated on the chart by the circles with dots) left the training course before the June rating.

than the critical score determined by the training school experiment, and neither of these was rated "good."

The third group examined consisted of fourteen high grade stenographers from five different companies. Each company was asked to have the test given to their three best stenographers. The lowest score made was 109 and the mean score was 153.

The data for the original training school group, and for each of the three supplementary groups tested, are given in Chart II. Scores in Test VI are represented by the abscissa, and the number of cases is shown by the ordinate.

From the investigation as a whole, evidence is found that there is a positive relation between mental alertness as indicated by Test VI, and ability in stenographic work. The designation of a score of 60 in this test as a "critical score" for selecting stenographers is justified by the data secured from these various groups.

CHART I.

RELATION OF SCORE IN TEST VI TO SUCCESS AND FAILURE IN STENOGRAPHY.

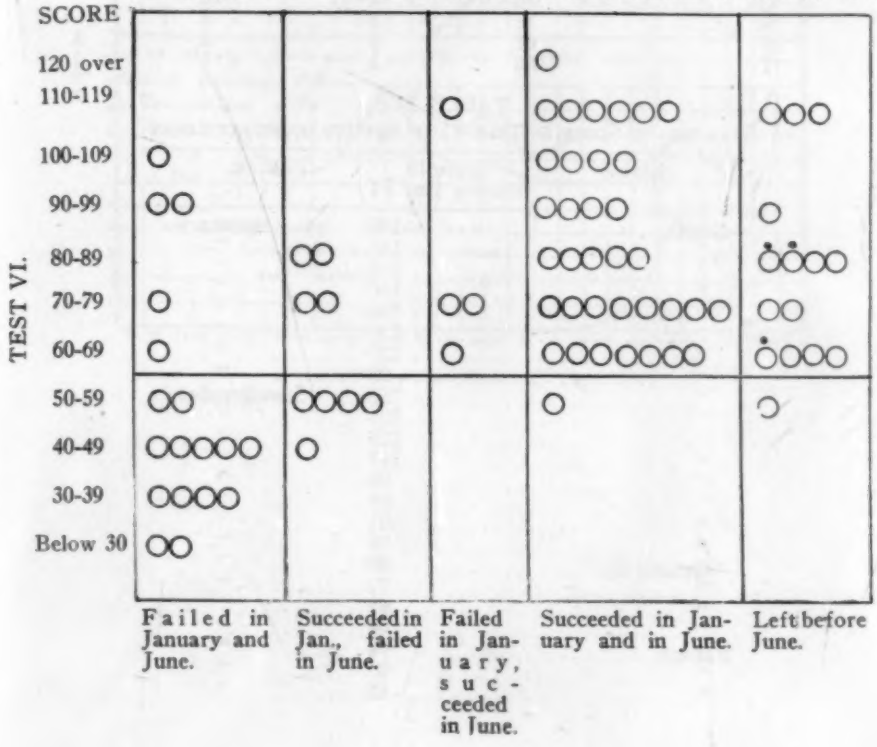


TABLE I

RELATION OF SCORE IN TEST VI TO VALUE TO FIRM OF TWENTY STENOGRAPHERS

	Score in Test VI	Ranking	Rating on Value to Firm by Office Manager
A	168	20	20
B	163	19	19
C	152	18	16
D	139	17	17
E	134	16	15
F	130	15	12
G	125	14	14
H	118	13	9
I	114	12	4
J	113	10.5	6
K	113	10.5	13
L	110	9	18
M	105	8	8
N	86	7	2
O	82	6	7
P	78	5	11
Q	76	4	10
R	72	3	3
S	61	2	5
T	52	1	1

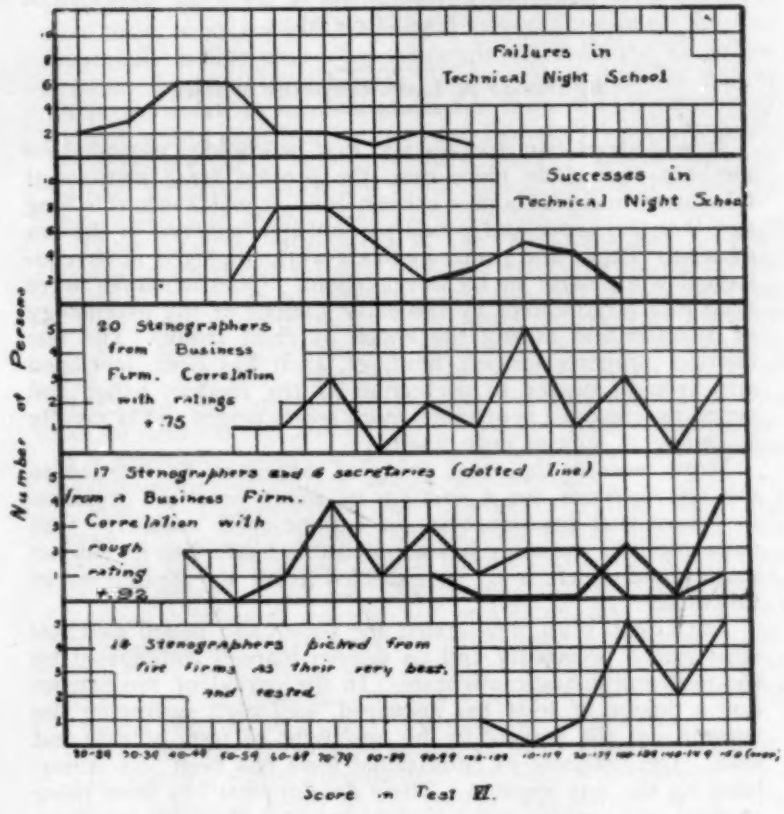
TABLE II

RELATION OF SCORE IN TEST VI TO ABILITY IN STENOGRAPHY

Rating	Score In Bureau Test VI	Position
Good	179	Secretary
"	155	"
"	152	"
"	150	"
"	150	"
"	139	"
"	137	"
"	93	"
"	155	Stenographer
"	129	"
"	125	"
"	117	"
"	94	"
"	91	"
"	91	"
"	78	"
"Getting By"	80	"
"	72	"
"	62	"
"	46	"
Failing	74	"
"	73	"
"	42	"

CHART II.

Relation of Test VI to Ability in Stenography


Failures in Technical Night School
Successes in Technical Night School
20 Stenographers from Business Firm. Correlation with ratings +.75
17 Stenographers and 6 secretaries (dotted line) from a Business Firm. Correlation with rough rating +.92
18 Stenographers picked from five firms as their very best, and tested.
Number of Persons
Score in Test VI.

PAPER AND PENCIL RESEARCH IN THE COLLEGE CLASSROOM

By Donald A. Laird, University of Iowa

It was about two decades ago that psychology extended its methods to include more than the prosaic brass instrument laboratory and philosophic convictions. It was about this long ago that the paper and pencil psychologist ushered in the era of tests. Paper and pencil methods were employed in psychological work early in its development. Questionnaires were used to a large extent by the early student of the psychology of religion and during the epoch of child study. The test method, properly termed, however, as it has been developed and brought nearer to perfection by the modern paper and pencil psychologist is of much more recent origin and is rapidly becoming a science unto itself.

More recently the staid study of education has turned to the test methods for a solution of many practical problems in educational procedure in an experimental manner. Still more recently sociology has adopted this method to its subject matter and much is to be expected from its application in this field.

The Great War precipitated the paper and pencil psychologist into a popularity and an esteem scarcely anticipated by the most enthusiastic advocate. In the period of reconstruction a deluge of tests has appeared, well nigh swamping the worker and the student in the onslaught of tests of this and that. The progress of educational tests has been less stimulated by the war impetus. Their development has been more gradual and perhaps more normal but still they are receiving increasing and just recognition and are being turned out in increasing numbers. Truly we are well into the test era.

It is not my purpose in this brief paper to cast a critical eye upon paper and pencil psychology, education, and sociology. Measured in terms of practical results much can be said for them. Viewed from other angles their hues are not nearly so roseate. For the present I must confine my remarks to another aspect of the test method which seems to be largely overlooked.

Under the urge to devise new tests and assist in the standardization of recent tests it has become the quite common

practice for the instructor to use his students not alone for contributing data but to lend a hand in the scoring and tabulating of the results. The pedagogical value of such procedure is at least nebulous if not positively doubtful. Certain it is that those who contribute the data receive negative returns. Especially is this true when, through the kindness of fellow teachers in other departments, a test which pertains not at all to the work at hand is given for the avowed purpose of obtaining data sufficient for the establishment of norms. Such instances are not of infrequent occurrence. Due to the large number of datum necessary for adequate statistical treatment this undesirable aspect becomes much magnified.

Those students who assist in the tabulation and the statistical treatment of the data probably receive some experience which is of slight educational value but whether or not this justifies the exploitation of the masses is an open question which it would seem should be decided in favor of the masses. The principal value attaching to the tabulation and treatment of data by the student is in training for research. Even this can be debated for plainly routine testing is not research nor is it especially conducive to a research attitude. As for the underclassmen—they are simply *Versuchtiere*.

Faculty committees are very prone to discuss ways and means for securing a better use of time by the students. To promote strict class attendance it is decreed that more than three absences from any course will cut into the credits received. Midweek parties are prohibited that the time of the students may not be utilized too largely in extra-curricular activities. It might be well for some of these committees to reflect likewise upon the instructors' opportunities for securing a better use of the students' time in the class room.

Now my thesis—one must always have a thesis nowadays—is that in a rather considerable and rapidly increasing number of instances much of the college and normal school students' time in the classroom is exploited by their teachers in paper and pencil research with but meagre, if any, returns to the student himself. As a judgment of value it would seem that if the students' time and efforts are to be utilized in the classroom it should be in a manner that will bring the students at least some momentary satisfaction if not something of permanent educational value.

I do not think I am making a mountain out of a mole hill. Anyone who has had an opportunity to observe the more recent progress and popularization of the test method cannot have failed to note that this is a factor which is assuming

a large magnitude in proportion to the pedagogical value which attaches to it in classroom routine. Almost innumerable examples could be given of this exploitation of classroom time within a single institution but for reasons which are on the surface it is perhaps best not to be too definite in the present communication. There is also probably little need of dragging in a large array of statistics for every college teacher is or should be aware of the situation which I have brought up for consideration. One who is given to playing with figures might treat this topic with results that would make the infant mortality charts furious with envy.

Probably no one will take offense if I use myself as my "horrible example." I have been guilty of using class time—lots of it—for paper and pencil research in gathering material which had not the remotest connection with their class work. I admit it blandly and complacently for I feel it has the stamp of social approval. The material I obtained, however, turned out to be extremely barren so now we refer to it as preliminary material. (Those who have been reading too much psychoanalysis please note.) To obtain this material three hundred students were detained from more worthwhile class work for a period of fifty minutes. The total time which I thus exploited was fifteen thousand minutes or two hundred and fifty hours. Thus through the willingness of two instructors and the dean of a college who aided and abetted me I consumed more than the equivalent of the time one student would have spent in class work during that quarter.[1]

But my experience is by no means typical. If this preliminary material had warranted more thorough work I would probably not have stopped short of a thousand cases. I also would have used other and more advanced classes for the marking, tabulating, and correlating. Which, again translated into terms of the average students' classroom schedule would mean an entire year's work!

A great deal has been accomplished in a practical way with the use of tests and their development should undoubtedly be furthered. Whether or not the college and university is the proper place for such development, however, is another question and one which I feel should be answered in the negative. The functions of a college or a university are instruction, furthering the sum total of human knowledge, and furthering its own interests. Let us take these up in the reverse order.

[1] It is just that I state that this is not the school from which I am writing.

One of the means by which an educational institution may further its own interests is to encourage its staff to contribute from time to time to the sum total of human knowledge. Thus in some respects the last two functions can be combined in one work. With the advent of paper and pencil research *mirabile dictu* it seemed as if by a sudden stroke of providence it would be possible to combine all these functions and fuse them together. Superficially this may be true. The first and all important function of an institution of higher learning, to which all other functions should be contributory, is instruction. And teaching is something far more than using classroom time. It is obvious that the development of tests—educational, psychological, sociological, and what not—in the class period is neither instruction nor education for the average run of underclassmen. The development of such methods and materials in the class room should be discouraged except, perhaps, in special classes organized solely for that purpose.

COMMUNICATIONS AND NOTES

A NEW LABORATORY IN CHILD PSYCHOLOGY

The Iowa Child Welfare Research Station at the State University has organized a Laboratory in Child Psychology for experimental work with children from 2 to 4 years of age. A new four-roomed building has been constructed and 24 children are now in attendance daily, in two sections from 9 to 12 o'clock. The laboratory is under the immediate direction of Dr. Bird T. Baldwin, Research Professor in Psychology, and Dr. Lorle I. Stecher, Research Assistant Professor, with graduate student assistants.

Oct. 12, 1921 B. T. BALDWIN

BOOK REVIEWS

Life—A Study of the Means of Restoring Vital Energy and Prolonging Life. By Dr. SERGE VORONOFF, Director of Experimental Surgery at the Laboratory of Physiology of the College de France. Translated by Evelyn Bostwick Voronoff. Pub. by E. P. Dutton, 1920. 160 p.

The cynic who casts all theories about the prolongation of life into the scrap heap made up of the use of sour milk, tobacco, malt liquors or the abstention from them will not have such ease in discerning flaws in the logic of Dr. Serge Voronoff.

His photographic evidence is hardly debatable, and his vital statistics hardly of the sort which we can suspect of having been juggled to fit his thesis. The book is written in somewhat popular style and the serious student wishes for more detail as to the surgeon's operative method and more exhaustive historical survey of glandular transplantation.

The chief defect of the volume is its omission of references to works of well-known American surgeons who have for at least six years actually performed these operations successfully on human patients. The author's work, however, was carried on chiefly with lower animals such as rams and goats. Nevertheless the book is broad in conception if not wholly so in execution.

In his first chapter he reviews the inverse relation of longevity to organic perfection in the animal series.

The second deals with the true cause of senility, viz. the persistence in our organism of the primitive non-specialized cells incapable of performing the functions of specialized cells, disorganizing them and arresting life. These primitive or conjunctive cells are originally indispensable to the body and we cannot destroy them. Rather must we try to moderate their tendency to rapid multiplication by increasing the vital energy of specialized cells, the sex glands offering the greatest source of such energy. By way of illustration the author cites the mental and physical effects of the removal of these glands in the case of eunuchs, and in contrast the examples of men of genius whose sex functions and artistic productivity were still vigorous very late in life.

Chapter V explains the failure of the Brown-Seguard method of injection in the defective means of preserving the extract, and presents the consequent arguments for the superiority of the graft method. Then follows Voronoff's report to the French Surgical Congress in 1912 of a lamb born of a ewe whose ovaries had been removed and replaced with others. In 1919 he reported grafting testicles upon females giving male characteristics and vice versa, grafting testicles on castrated males and aged males followed by disappearance of their infirmities, restoration of reproductive power and prolongation of life many years beyond that ever hitherto recorded for such animals.

In conclusion he calls attention to the scientific possibility as yet not legally sanctioned, of securing human glands from men killed by accident or from executed criminals, because glands may be kept alive for weeks in refrigerators of zero temperature. But failing this a substitute for the human thyroid is found in that of the higher simian. The identity of secretions and effect of their action on other than the

same species is described. To be specific, a patient whose thyroid mechanism at birth was devoid of blemish had measles at eight years resulting in myxoedema and imbecility. After much experimentation with injection and thyroid tablets, the continuance, suspension and resumption of such medication, a graft from an ape brought a complete recovery and mental awakening. Other interesting examples are reported and finally emphasis laid on the service of augmenting internal secretions of persons the usefulness of whose acquired experience and accumulated knowledge is enhanced by prolonged life and stimulation to intellectual work.

The appendix contains the findings reported to the Biological Society of detailed microscopic examination made by M. Ed Retterer upon Dr. Voronoff's grafts.

Vassar College. MIRIAM C. GOULD.

A Study of the Mental Life of the Child. By VON HUG-HELLMUTH, H. Translated by James J. Putnam and Mabel Stevens. Nervous and Mental Disease Pub. Co., 1919. 154 p.

This monograph does not claim to represent the outcome of a judicial weighing of all the factors that go to make the infant and child what they are, says Dr. Putnam in his preface, but it describes a certain very important group of factors that make up the sexuality of childhood.

The author in a way disarms the critic by acknowledging the usefulness of other's modes of classification and choice of emphasis, by recognizing objections to her own plan of treatment and warning that the very special mental tendencies she describes as if existing independently, in sharply defined epochs of childhood in point of fact however, run on through the whole duration of childhood. In no sense is the supposition justified that she conceives of the child's life as a thing marked off into periods on the very arbitrary basis she has adopted for convenience, namely, the nursing period, the play period, and the period of serious study.

Dr. Hellmuth writes in a highly popular style, using for illustrative material her own nephew and many observations of Preyer, Shinn, Scupin and Sully, who have studied the child by the biographical method but not the Freudian interpretation. Stern and G. Stanley Hall are additional sources, but there is little or no reference to further contemporary investigation.

Whatever our views concerning the acceptability of the Freudian accent on the entire gamut of situations and response in childhood, no reader can fail to grant the universality of most of the observed behaviour on which she comments. We are not so ready to admit all of the author's generalizations whose logic is glaringly open to attack by experimentalists who have contradictory data.

Child behaviour. A critical and experimental study of young children by the method of conditioned reflexes. By FLORENCE MATEER. Badger, 1918. 239 p.

This is a technical volume dealing with the Pavlov Method which was first applied to normal children by Krasnogorski in studying the development and decadence of conditioned reflexes and inhibitions in sucklings and young children, later to cases of neuropathic and feeble-minded children.

The author criticizes Krasnorgorski's account of his experiments for its serious omissions and says "the claims made by Krasnogorski for his method and findings are so great that a verification or disproof of them seems to be demanded from the standpoint of both experimental and clinical psychology. If the method is so easily and accurately applicable and allows so many variations, it opens up to the experimentalist a most promising avenue of attack upon the infant mind. If it differentiates with such accuracy the defective and pathogenic child while he is still young enough for preventive education and corrective therapy to have a chance it will revolutionize our present clinical methods." It is this that Dr. Mateer seeks to ascertain by a modified methodology and technique. She describes in detail her procedure of procuring the 50 unselected normal children under 7 years of age in a village, the establishment of rapport, the activities preliminary to the experimentation, the social, hereditary physiological study of the subjects, the other groups of defective children in the Mass. State School for Feebleminded and of suspected or observation cases similiarly tested and the additional extensive studies she made of individual children.

Preliminary experiments upon a few subjects were made with the aim of studying and understanding the method itself. A series of standard clinic tests for determination of mental levels were used such as the Goddard Revision of the Binet Scale, the Yerkes Point Scale, Healy Boards, the Goddard adaptation and form boards. Kymograph records were then made of movements in establishing conditioned opening of the mouth through a cutaneous stimulation of the inner side of the right arm above the elbow, originally associated with feeding sweetened water or candy. Specificity and discrimination of cutaneous stimuli were studied in the same manner.

The main experimental results are as follows: (1) 3-9 trials necessary in normal children to form a sensory-motor association, 3-18 in defectives. The necessary number decreases as age increases up to 60 months. Under two years boys are more rapid than girls, above two years the order is reversed. The number of trials varies more among girls than boys. The rapidity of learning or acquiring a conditioned reflex correlates with intelligence.

(2) The number of trials necessary to obtain memorial refunctioning after an interval of 24 hours is from 2-7. 70% of the normal subjects reacted at once; 57% of defectives with 2 trials, the rest 3-7.

(3) The most rapid learners retain best. Girls are the most rapid.

(4) The number of trials necessary to effect unlearning of an associative act when conditioning stimulus is absent is 3-12 for normals, 8-21 for defectives. The number decreases as age increases, and number of trials for learning increases. Boys are most rapid.

(5) No perceptible difference in children of all ages or either sex in number of trials necessary to correct the unlearning and restore refunctioning of first associations.

The author makes no claim of finality in her finding, but points out their significance in our progress towards the use of objective methods of child study.

She does not advocate their substitution for other clinical methods, but simply their addition because our information concerning the organism becomes more certain by studying the variations of behaviour under definitely ascertained conditions of stimulation.

To quote Miss Mateer "Psychogenetic or biographical studies were and are valuable. They have been the pioneer path-breakers that

indicate the extent of the problem confronting us, but now exact definitization of facts demands quantitative studies under controlled experimental conditions and an unbiassed presentation of the results obtained." However she warns against inferring too much from arbitrary situations, cold manipulation, and forgetfulness of the child as an individual.

Her survey of the history and results of child study up to the present is thorough, yet admirably concise.

Vassar College MIRIAM C. GOULD.

A Study of Women Delinquents in New York State. By MABEL R. FERNALD, MARY H. S. HAYES and ALMENA DOWLEY, with a statistical chapter by Beardsley Ruml and a preface by Katherine Bement Davis. Publication of the Bureau of Social Hygiene, N. Y. The Century Co., 1920. 542 p.

This is the first extensive study of women delinquents given expert statistical treatment with modern methods. Its 225 tables are critically analyzed and conclusions summarized at the end of each chapter, making the work satisfying alike to readers with or without a thorough comprehension of the technique used.

Unfortunately the data are confined to mental capacity and the main facts, of personal and environmental history, because adequate data for physical and medical facts could not be obtained.

The groups studied were (1) N. Y. State Reformatory women between the ages of 16 and 30 convicted of felonies and misdemeanors; (2) Auburn State Prison felons; (3) Magdalen Home Sex offenders; (4) N. Y. County Penitentiary; (5) Workhouse, and (6) Women's Night Court cases. Inebriates were omitted because of inability to obtain accurate information from them, but this eliminates many mental defectives and therefore introduces a serious source of error. A further defect is the variation in time period over which cases in the different institutions were examined. No control series for comparison with the normal population was used and comparison with men criminals was futile because the offenses of male convicts are not comparable.

Mental condition was ascertained by the Binet Simon 1911, Yerkes, Bridges and Stanford Revision Scales, the Wooley series, some educational and individual standard tests of ability. Social investigations were made through visits to the home, relatives, employees and other agencies having knowledge of the offender. A correlation of .38 was found between delinquency and intelligence, also significant correlations between mental capacity and type of occupation, mental capacity and earning capacity, age and number of previous convictions, age at first conviction and condition of the home.

No correlation was found between age of leaving school and age of first conviction, nor between grade reached in school and number of convictions. Lack of education, therefore, is not responsible for delinquency.

Furthermore, the popular conception that low and irregular wages are responsible finds no confirmation here, for a positive correlation could not be found between earning capacity and number of convictions.

Foreign white women made up a smaller percentage in each institutional group than is present in the population as a whole, yet the offenses of the foreign delinquents were more serious on the whole than those of the natives.

There were more domestic workers in the group than in the general population and a lower average standard of education among them than in the other occupations represented. The older women had a lower grade of education than that reached by the younger cases.

No relation appeared between intelligence and habitual use of alcohol, drugs or cigarettes, but the prostitutes were distinctly mentally inferior to those whose crimes were against property.

In 15.9% of the delinquent's families some other member had been convicted of crime, but the data was too inadequate to enter into a study of hereditary aspects. Most of them were from self-supporting families and born of parents not at age extremes.

In several particulars the findings are in substantial agreement with those of Goring's figures for the English convict, but the authors are cautious in their deductions and fully aware of the inconclusiveness of their evidence.

MIRIAM C. GOULD.
Vassar College.

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